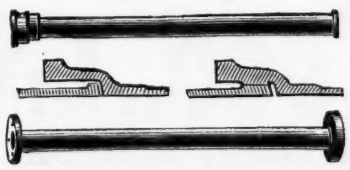
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXX. No. 1788.] LONDON, AUGUST 17, 1897. [49TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



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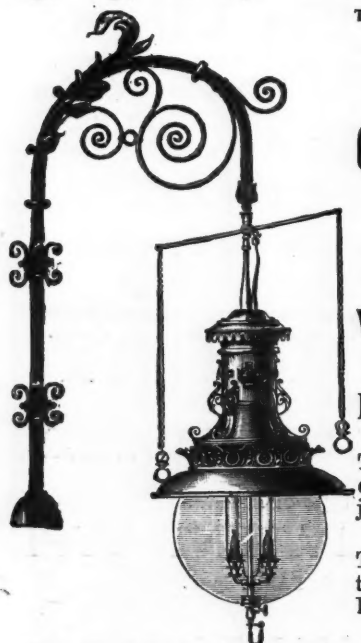

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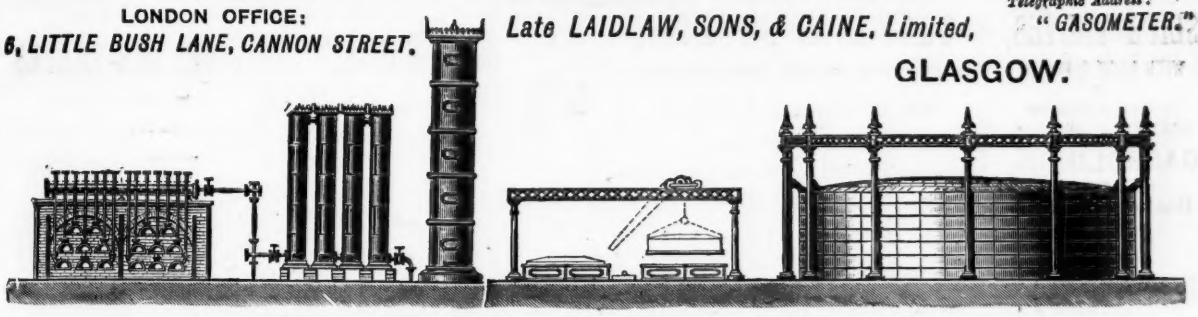

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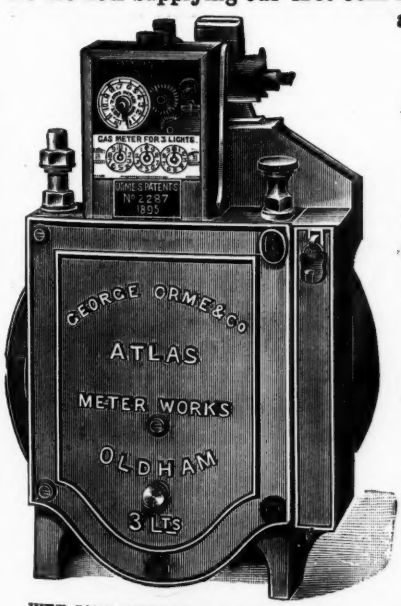

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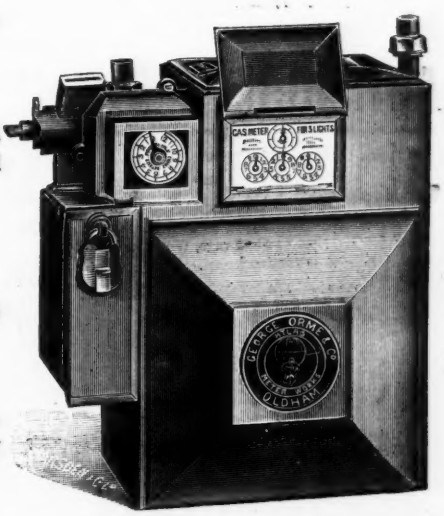

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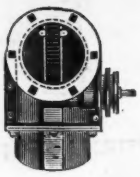

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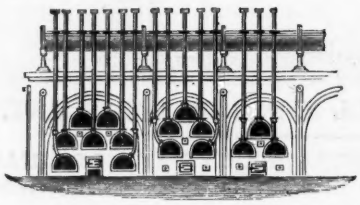

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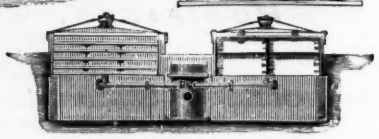

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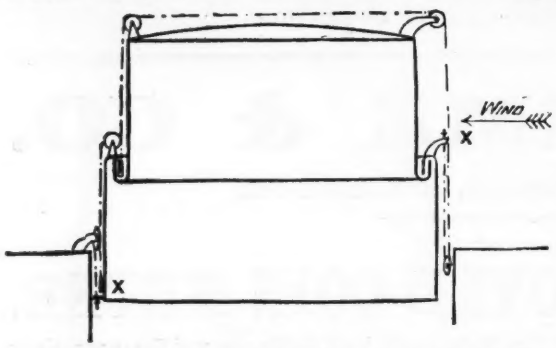

ONE $\frac{3}{4}$-inch Steel Cable in Double Purchase has a controlling power of **60 TONS**

WIND at 30 lbs. per foot has an overturning power of less than **9 TONS**
in the case of a Holder of Two Lifts, 100 ft. by 20 ft.

A Gasholder on the Cable System can rely on a support which is exactly known in amount, is direct and simple in application, and is exerted through the strongest parts of the framework only.

A list will be published next week of some of the 52 Cable Holders erected or on order.

N.B.—If the holder were always at one height, the Cables might be fastened at XX. *The support that the Holder derives from the Cables is equally perfect, notwithstanding its rise and fall.*

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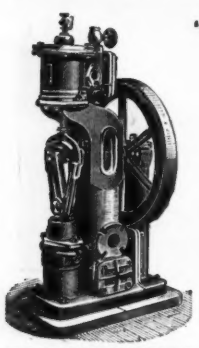
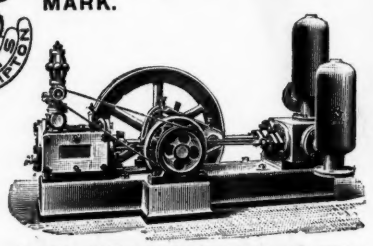


Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.



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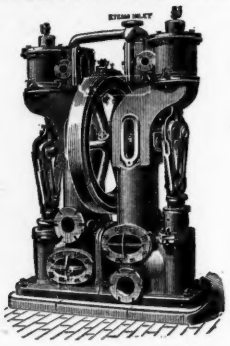

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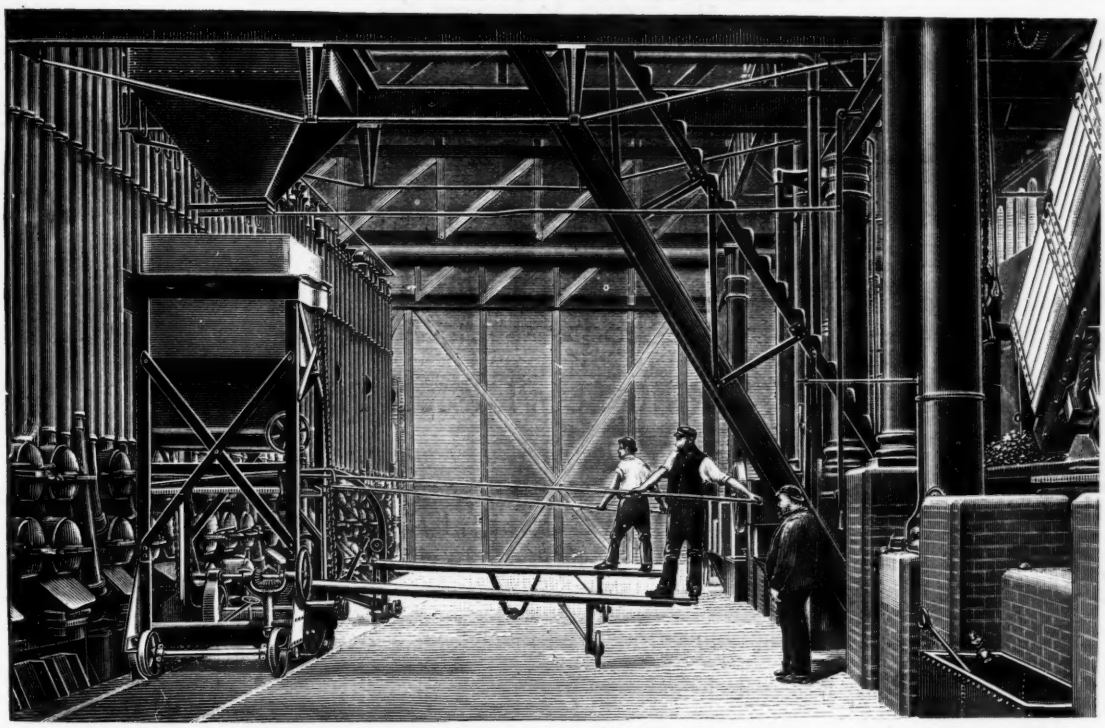

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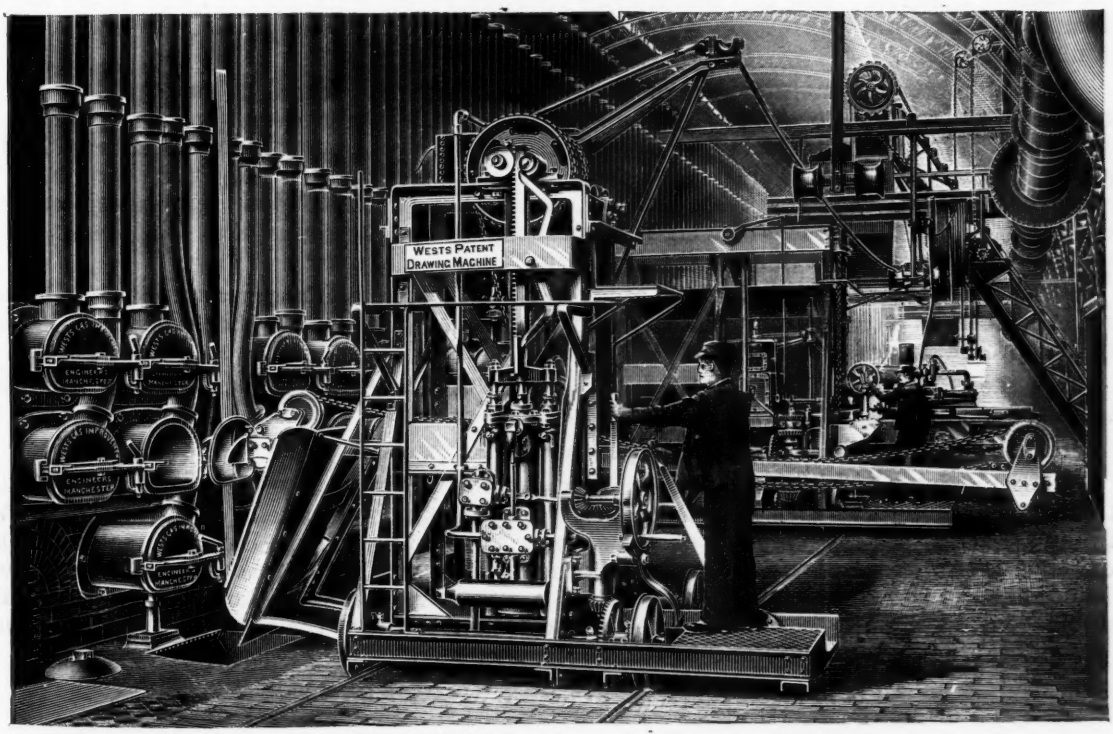

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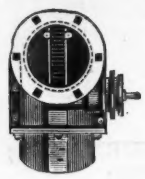

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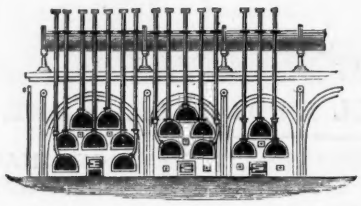

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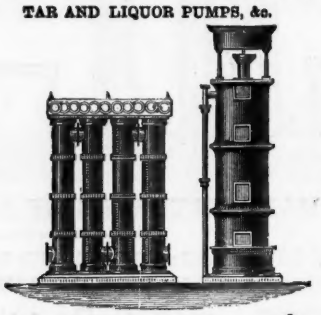

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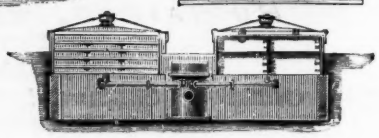

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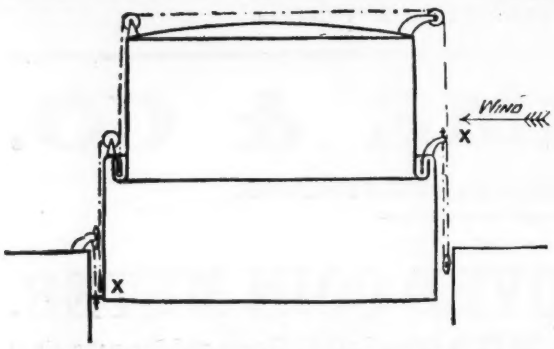

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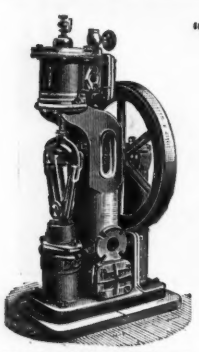

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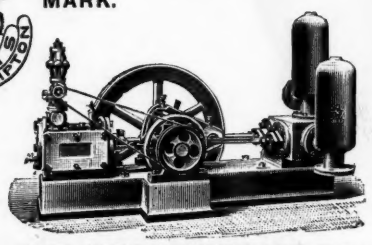

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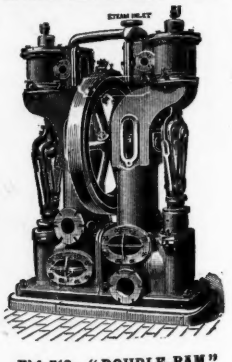

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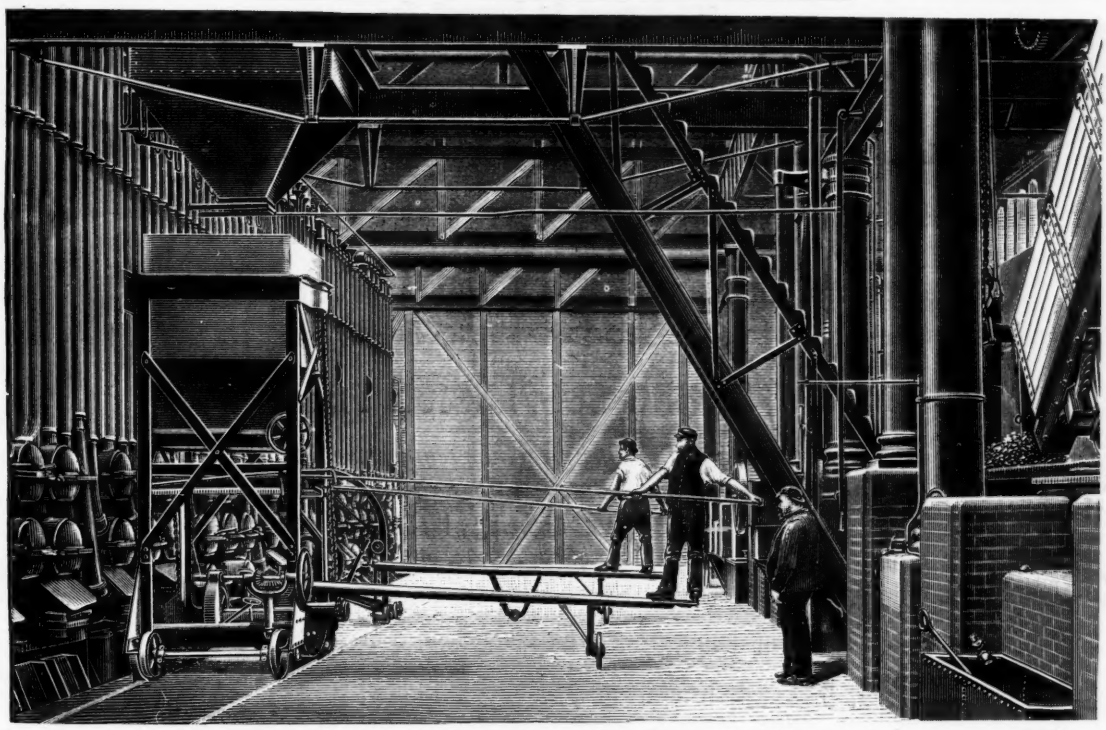
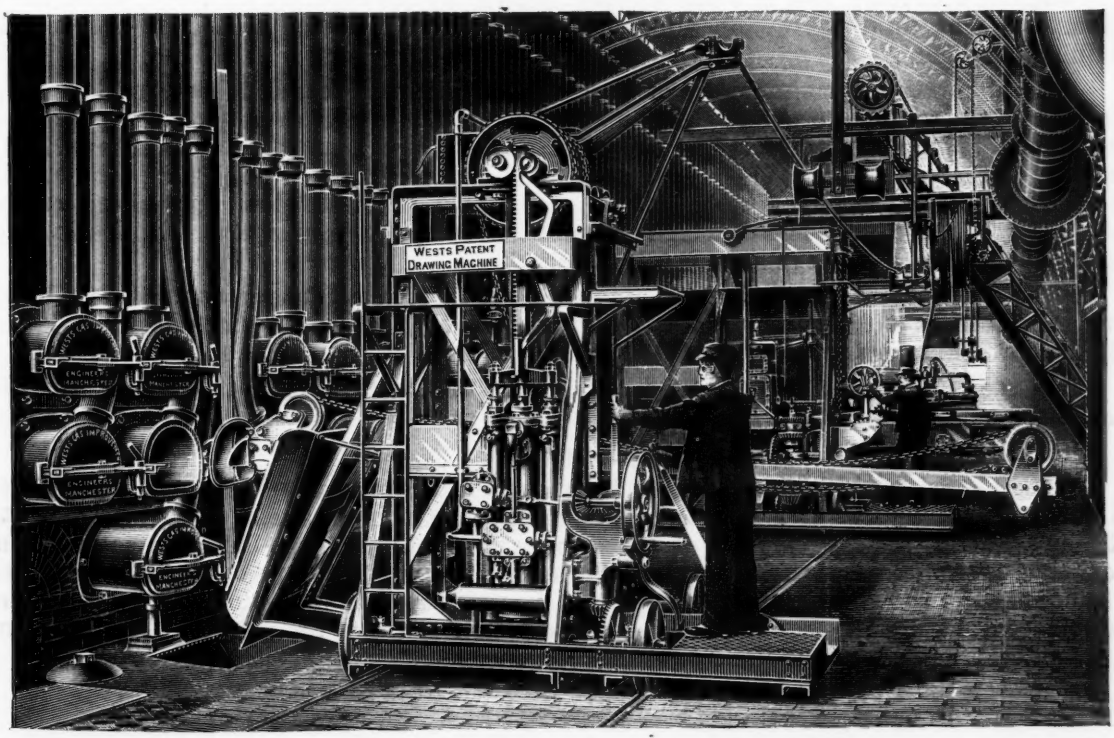


West's Manual Charging and Drawing Machines.



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Highest Efficiency with Greatest Economy.

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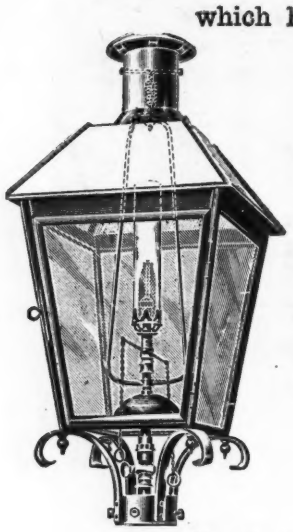
are invited to inspect the

INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of



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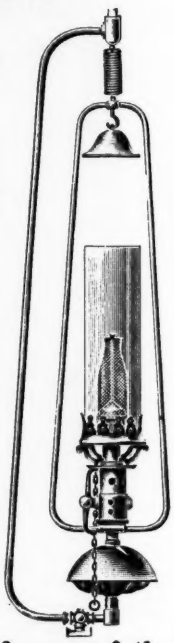

The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

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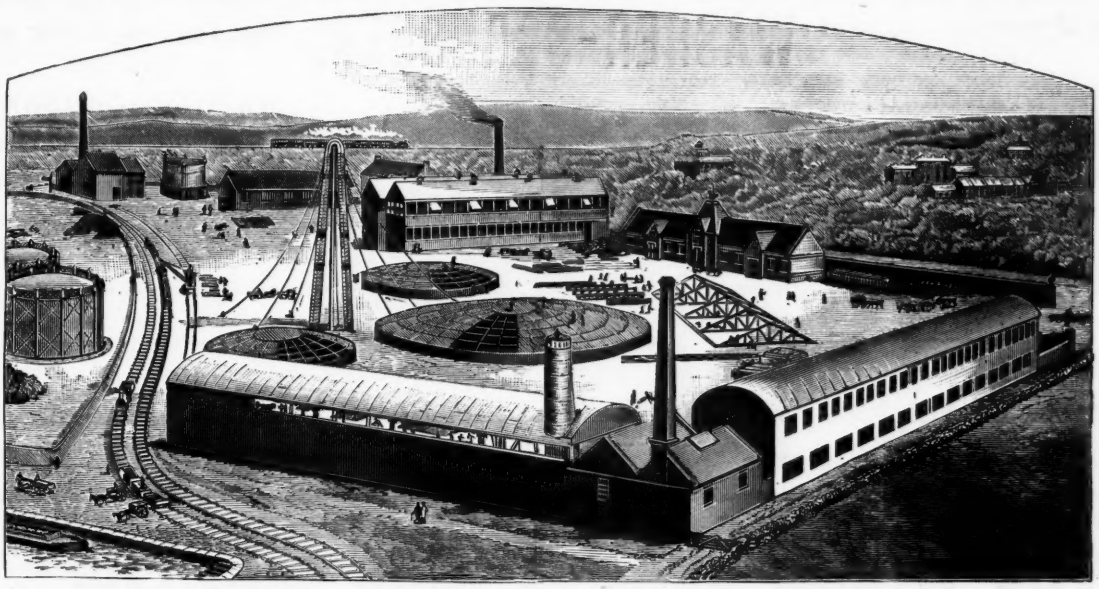

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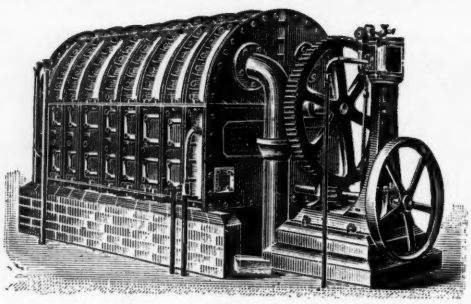

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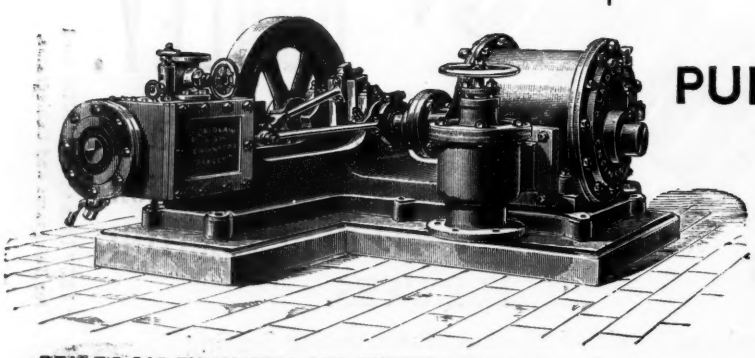

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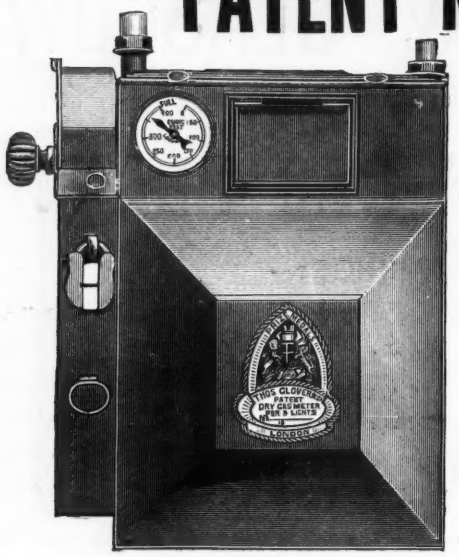

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EDITORIAL NOTES.

The South Metropolitan Company's Meeting.

THE meeting of the South Metropolitan Gas Company last Wednesday was rendered interesting by being made the occasion for the delivery by the Chairman—Mr. George Livesey—of one of the ablest speeches that even this acknowledged master of gas politics and administration has ever uttered. It is possible for gas engineers to disagree with Mr. Livesey occasionally, and to think him generally headstrong, and not always well advised; but there is no other man living who can command the attention that is given to him as a matter of course when he speaks from the South Metropolitan chair. The first portion of his address on this occasion was devoted to the thorny subject of gas-works rating; and we must refer our readers to the report which appears in another column for insight into his particular manner of treating the topic. Mr. Livesey has challenged us before now for calling him a fighter; but this speech, from start to finish, is a regular "Balaclava *mêlée*," to borrow a simile from the official phraseology of the Military Tournament. First of all he "went for" the parishes that had put up the Company's assessment; and next he fell upon the marauding surveyors, and exhibited their manners and customs in a light that had never, surely, been thrown upon them before. The natural conclusion of this part of the speech referred to the remarkable step taken by the Directors of giving notice of an increase in the price of gas in those parishes where the assessments exceed those in force in the principal parts of the district. It is difficult to reconcile oneself to a proceeding such as this, which threatens to punish the inoffensive gas consumers of a district for the imputed sins of their local authorities. At the same time, something must be done to bring these same local authorities to a sense of what gas-works rating means. It is perhaps unreasonable from one point of view that the gas consumers (say) of Lewisham should pay 1d. per 1000 cubic feet more for their gas than the consumers of the parish of Newington, served by the same Company; but then, why should the parochial authorities of Lewisham be allowed to mulct the Company in rates calculated upon a higher assessment than that which satisfies the authorities of Newington? It is the absurd system of allowing every parish, or union of parishes, to do anything that may appear right in its own eyes by way of assessment that is thus illuminated by the retaliatory measures taken—somewhat reluctantly we may well believe—by the Directors of the Company whose pride and boast it is to sell the cheapest gas in London.

Mr. Livesey took occasion to point out the advantage enjoyed by the Company of not paying away their full statutory dividend, but keeping a little in hand, which confers a degree of elasticity likely to be useful on occasion. There was not much to say upon the figures disclosed in the accounts. It was pointed out that if the residuals values of 1894 had been maintained, the Company would now be able to sell gas at 2s. per 1000 cubic feet; but this is "past praying for." The conflict of policy in regard to dealings in coke between the South Metropolitan and Chartered Companies was displayed without mincing of phrases. Lastly, the address dwelt upon the question of labour. It contained the most uncompromising denunciation of Trade Unionism that has yet appeared in print. Mr. Livesey did not leave a loophole of escape from the conclusion that where Trade Unionism reigns, there the "Union stroke" rules the output. Here is, he means to say, the secret of the extravagant charge for carbonizing wages in works where the Union is "recognized." Whether it is men or machines that do the work, the "Union stroke" pervades, and characterizes the result. Statisticians may accept and work out the figures; but Mr. Livesey has no hesitation in grappling with them, and ascribing them to their source. He charged Trade Unionism roundly with being based upon tyranny and dishonesty. Not all Unions came in for this sweeping condemnation, but only those which encourage the use of the "Union stroke"—which means, in practice, the spreading of one man's work over three. It is a terrible charge for a man to make against any human organization. But it stands to Mr. Livesey's name; and he is not likely to run away from it. To be able to refute him would do Trade

Unionism more good to-day than all the brass bands and banners, and International Congresses, and mass meetings that have ever been enlisted in the cause.

The Dispute in the Engineering Trade.

THOUGH the newspaper reports of the progress last week of the dispute in the engineering trade are voluminous, the purport of the whole can be expressed in the single observation that the area of disturbance was extended, while no advance whatever was made in the direction of a settlement. The official communications from the head-quarters of the Amalgamated Society of Engineers made the most of every instance of a firm having conceded the 48-hour week; while on the other side the adhesion of fresh districts to the Employers' Federation was almost daily reported. No attempt is made by either side to minimize the gravity of the present issue; and it is apparently the desire of both parties to the dispute that there shall be no mistake about the character of the settlement, whenever it comes. The meeting of the Iron and Steel Institute at Cardiff gave an excellent opportunity to the special correspondent of "The Times" for ascertaining at first hand the views of a good number of large employers of mechanics regarding the purpose of the strike; and he gathered from them that they think it a very serious business indeed. "The issue is regarded as "being of vital importance to all employers of labour, or, "in other words, to the trade of the country. In fact, it "is patent that Trade Unionism generally is engaged "in a great campaign, and that the object of that cam-"paign is to obtain for the Trade Unions a far larger "share than they have hitherto enjoyed in the manage-"ment of industrial enterprises." Meanwhile, Mr. George Barnes, the General Secretary of the Engineers' Society, has published a declaration that "the eight hours for "London is practically won. Conciliation or arbitration, "mediation or conferencing, upon that question cannot "be entertained; and if by any chance either of the "firms who have locked out here at the behest of Colonel "Dyer should beat us now, then it would simply mean "that such firms would in future be reckoned as outside "recognition, excepting in so far as it would get our "hostility in the placing of orders wherever we could "make our influence felt. Most of them are Government, "municipal, and co-operative contractors; and our mem-"bers will act accordingly." While this spirit inspires the counsels of the A.S.E., there is not much chance of a peaceful or an early settlement. If the men are truly bent upon ruining their employers, the latter may as well take it fighting as lying down.

The only gleam of hope for the trade lies in the truth that Mr. Barnes and his associates are not everybody, even in the engineering and allied trades. These tyrants are very sore indeed about the independent action of the Boiler Makers' Society, whose experienced leader, Mr. R. Knight, has declined to dance to their piping. Hence come complaints that boiler makers are doing some of the acknowledged work of smiths, fitters, coppersmiths, and hammermen in many of the locked-out shops. In the usual rhodomontade of the A.S.E. executive, who seem to be relying more on the wind power of Mr. John Burns and Mr. Tom Mann than on any other assistance, these complaints have caused a "profound feeling among the allied representa-"tives against such betrayal of the traditions and prin-"ciples of Trade Unionism; and it is the expressed deter-"mination of some of the delegates who have to attend "the coming Trade Union Congress at Birmingham that, "unless this renegade warfare be discontinued, it will be "their duty to make an exposure across the floor of the "parliament of labour to the whole of the Trade Union "world." Mr. Knight probably regards himself as just as well qualified to rank as an authority on true Trade Union principles as the new wire-pullers of the A.S.E.; and he may be credited with knowing the business of his own Society better than the latter. For this reason, his last monthly report to the members of this organization possesses unusual interest. Having recorded, by way of preliminary, the fact that the Society is a growing one, he goes on to explain that it belongs to "the older Trade "Unions, whose primary object was the securing of better "conditions of labour and higher remuneration for its mem-"bers, but incorporated with these objects the payment "of such provident benefits as unemployed, sick, accident, "superannuation, funeral, and others. These societies have "been the backbone of Trade Union movements, and have "been the means of conferring many important advantages "upon the industrial classes of the country." The last sentence quoted is obviously a rejoinder to the new style of Trade Union politicians. That these old-fashioned views of the office of a Trade Union are not yet obsolete is indicated by the circumstance that the National Society of Drillers, with a membership of 5000 and a capital of £10,000, have applied to amalgamate with the Boiler Makers. We believe it is the honourable boast of Mr. Knight that while the executive of the Boiler Makers' Society have never organized a strike and have kept their money, they have secured all the advantages possible to be obtained by a Trade Society operating in its legitimate sphere.

Meeting of North of Ireland Gas Managers.

ON Tuesday last the members of the North of Ireland Association of Gas Managers met at Omagh. Mr. J. Nisbet, of Portadown, the Vice-President of the Association, took the chair in place of the President, Mr. M. Martin, of Drogheda, who was prevented from discharging this part of the functions of his office. Mr. Nisbet delivered the brief address which appears in another column; duly acknowledging the use and growing strength of the Association. The bulk of the address is composed of practical observations. At its conclusion, Professor Ivison Macadam delivered a lecture on "Carburetted Water Gas," excellently illustrated by experiments and limelight views. At the last year's meeting of the Association, it was decided to try and encourage the contribution of papers to the proceedings by offering medals; but the offer has only been effectual in evoking one paper from a member. This is disappointing. The paper was by Mr. P. Egan, of Tralee—a patronymic of distinct literary flavour—who accordingly received the prize. A paper by Mr. C. B. Outon, of Inchicore, descriptive of an acetylene gas plant used at one of the stations of the Great Southern and Western Railway, was read by the Secretary (Mr. J. Whimster, of Armagh). The Association received a welcome to Omagh from Dr. Fleming, on behalf of the Directors of the Gas Company. The second day of the meeting was devoted to an enjoyable excursion to Lough Erne, with its 365 islands, which is one of the many picturesque parts of Ireland deserving more attention from tourists than has hitherto been accorded to this part of the country.

Alterations of Parliamentary Standing Orders.

SOME rather important alterations of the Standing Orders of the House of Lords were made just before the prorogation, and will have to be complied with in connection with the initial stages of Bills introduced next session. The definition of the term "parish" is, as respects England and Wales, "a place for which a separate poor-rate is or "can be made or for which a separate overseer is or can "be appointed;" thus cutting out purely ecclesiastical parishes. The meaning of the term "district" as regards the divisions of the Administrative County of London is also defined afresh. Some new regulations are made with respect to the deposit of plans and the giving of notices; striking out the requirement to make such deposits with parish clerks and some other local officers. Standing Orders 29 and 29*a* are omitted; and a new Standing Order (29) is framed, stating with whom deposits of plans and copies of parliamentary notices are to be made. The giving of notices in the event of alterations of Bills in progress is also simplified. The passage of Local Bills will be facilitated by an alteration made as to the method of dealing with such Bills in cases where opposition shall be withdrawn or defeated on *locus standi*. A highly important new Standing Order, numbered 105*c*, runs as follows: "Where "the council of any administrative county or county "borough petition against a Bill, alleging that such "county or county borough, or some part thereof, will be "injuriously affected by the Bill, it shall be competent for "the Select Committee to whom the Bill is referred, if "they think fit, to hear such petitioners or their Counsel "or Agents and witnesses on such allegation against the "Bill or any part thereof." This regulation appears to throw open the way of opposition to Local Bills by such authorities as may allege that their district will be injuriously affected by the provisions of the measure, without qualification of any kind. It is left to the Select Committee to decide whether such petitioners shall be heard; but it is not going too far to say that this discretion is not likely to be exercised against local authorities. If this

reading of the new Standing Order is the correct one, the way of promoters of Local Bills will not be smoother than it has been of yore. The regulation is another step in the direction of increasing the power and influence of local authorities over Private Bill Legislation; and though this movement is quite in accordance with the bent of popular politics at the present time, it is fraught with momentous consequences for various statutory undertakings, such as those connected with gas supply, which appear in the estimation of the general public to be purely local concerns. Those who are inclined to look with disfavour upon the encouragement of municipalities to spend money upon parliamentary warfare will not readily accept as wisdom anything that relaxes the present obligation, slight as it is, upon these authorities to appeal to Parliament only upon definite issues. The London County Council, which is not subject to the restraint of the Borough Funds Act, will be able to plead the countenance of the House of Lords in entering upon any amount of "sporting" parliamentary opposition to gas and other Bills in the future. It is so very easy to conjure up the phantom of injurious consequences in connection with the most harmless scheme of legislation; and with reference to the new Standing Order, the gentlemen of the Parliamentary Bar and all Westminster will have good reason to raise once more the strain of praise and thanksgiving for the House of Lords. The danger may, of course, be more apparent than real; but the prospect is not a peaceful one.

The Work of the Session.

Pressure of matter last week prevented mention in these columns of the prorogation of Parliament, after a session of extraordinary interest and importance. From the point of view of the strict party politician, to whom nothing matters but Ministerial crises and the fortunes of placemen, the session was dull in the extreme. To those who regard Parliament as an agency for doing the legislative and superintending the executive work of the British Empire, and care not a straw for the small personalities that bulk so disproportionately large in the ordinary newspaper reports and comments on doings in the Houses, the past session was one of the most satisfactory of recent times. A very good exposition of the former view of the proceedings of Parliament appears in the current number of "Blackwood," where the statement is offered that the session of 1897 "will certainly remain on record as an "example of what can be done very easily in little more "than six months by a House of Commons which is bent "on business." The reviewer discusses the Workmen's Compensation Bill by the light of criticisms on what were called the "socialistic proclivities" of the Ministry. This brings to the fore the vexed question whether or not the Act does or does not extinguish contracting out. The point is by no means settled even yet; but it is a valid argument that if no new legislation were to be attempted until every possible consequence and application of it could be foreseen and secured, very few Acts of Parliament would ever be added to the Statute Book. "And a very good thing too," may be the reflection of those who are disposed to consider that "we are governed "too much." Still, while the average citizen feels that, under Providence, the Imperial Parliament is the means upon which the working world can most confidently rely for improving its condition, so far as legislation can do it, legislators and their supporters must be prepared to incur some risks. The reviewer takes up Lord Salisbury's point that those who call the Compensation Bill "socialistic" do not know what Socialism really means. "Socialism "would throw on society the proper work of individuals. "The Bill throws on individuals what Socialists would "throw on society." After this great industrial reform, it would be descending into bathos to mention the few and small Public Bills which more or less affect the national industries. Another session has gone by without any attempt having been made to settle the question of the legal standard of light; and no other point of detail arising in connection with the gas industry has engaged the attention of Parliament. It is fortunate that the industry can, on the whole, dispense with the good offices of Ministers, and, in this country at any rate, has no need for the services of politicians. But we do wish the Board of Trade would now do something to place the statutory photometry of gas upon a sounder footing.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 398.)

After the rise in prices which most departments of the Stock Exchange had recently been effecting, the tendency last week was rather in the opposite direction. Two or three causes conspired to bring this about. A disposition to snatch a profit on sales set in; money came into better demand, so that the value appreciably rose; and the settlement chiefly occupied attention, to the detriment of new business. Under these circumstances, the tone naturally became flatter; and the markets in general were quieter. Gas securities were, for the most part, much neglected; and if it had not been for considerable activity in the leading issue, the aggregate of business would have been light indeed. But Gaslight "A" was fairly busy almost every day, and steadily advanced in price from 316 *cum div.* on the opening day to 315 *ex div.* on Friday—an advance of nearly 6 points. This was somewhat remarkable, seeing that on Monday, at the Mart, the Directors were not able to get an average of quite 307 for the £25,000 of like stock which they were issuing, free, of course, of stamp duty and commission to buyers. Hardly any business at all was done in the secured issues; but each one participated in the buoyancy shown by the ordinary stock, and was quoted at a nice advance *ex div.* Very little was done in South Metropolitan; but it showed its strength by changing hands more than once at 147 *ex div.* One single deal saved Commercial from absolute stagnation; the price remaining unaltered. All the Suburban and Provincial Companies were quite overlooked; and none showed any variation, except Crystal Palace, which advanced *ex div.* The Continental undertakings also were very little dealt in. Imperial continued to suffer from weakness, and lost 5 points in the week, though the debenture stocks were firm; but Union was stronger, and rose in price. A few small movements were noticeable among the remoter undertakings. Melbourne debentures and Cape Town ditto were rather better; but Ottoman had a slight fall. Business in Water stocks was about the same as usual, with a favourable tendency generally; and a few quotations advanced—Kent leading the way.

The daily operations were: Business in Gas was quiet on Monday; and prices in general were good. Gaslight "A" rose 1, and Cape Town debentures ½; but Imperial fell 1. Kent Water moved up 3. Tuesday's transactions were almost exclusively in Gaslight "A," which was steady and unchanged. Kent Water advanced 3 more. Things fell quiet on Wednesday; but prices were still better. Gaslight "A" rose 2, and Union 1; but Imperial fell 2. In Water, Chelsea gained 1; and East London 1¼. Thursday was extremely quiet. Several issues advanced *ex div.* Melbourne bonds rose 1; but Imperial fell 1, and Ottoman ¼. Friday was more active, especially for Gaslight "A," which rose 1. Both Union issues advanced 1; but Imperial fell 1. A single transaction in Imperial was the whole of Saturday's business.

ELECTRIC LIGHTING MEMORANDA.

The Obstacle to Popular Electric Lighting—The Disadvantage of the Prepayment System—Cost of the System—New Wiring Rules.

It is a good illustration of the way of the world that the chief difficulty that obstructs the career of most electricity supply undertakings is one of an extremely commonplace character, wholly unconnected with any of those high and obscure problems of the science of electricity which engage the study of experts and strike the popular imagination by their mysterious suggestiveness. It is nothing more nor less than the question of wiring consumers' premises with safety and at a cost suitable to the means of the average householder. It seems a platitude to mention this matter in this way; but recent proceedings in the world of finance serve to remind one that the commercial future of domestic electric lighting is in the hands of that new development of the "three-branch hand"—the working electric light fitter. Whether any noteworthy results will follow upon the latest attempts to bring electric lighting into the homes of the people by an adaptation of the "penny-in-the-slot" method that has, on the whole, proved so successful with gas, remains to be seen. Something will have to be done, it is evident, to increase the absorbing capacity of populous areas for electricity, if many of the central stations actually in operation are ever to pay their way. In the case of Kingston-on-Thames, to name an example recorded in our last week's "Electric Lighting Notes," extensions of mains are going on without much actual encouragement from the public. The time-honoured expedient of "canvassing the neighbourhood" does not produce a heavy crop of advance orders; and though the opinion expressed by the Borough Electrical Engineer is doubtless sound, that when the supply is actually brought to people's doors they often take it, yet the process of putting in new house connections is a slow one after the first few demands have been satisfied.

In discussing this question of the popularization of electricity supplies by artificial means, such as the prepayment meter

system, it is necessary to bear in mind that the differences between gas and electricity, from the consumer's point of view, are greater and more prominent in the class of business naturally covered by this system than in any other. In the case of gas, to begin with, automatic meter supplies cannot be introduced everywhere upon equal terms and with equal success. There are whole towns, and considerable regions of towns, where the system cannot be made successful for various reasons that appear when the experiment is tried; and there are others where it involves heavy capital outlay which can only be wiped out after a long period of time. Yet gas is cheap; the fittings are inexpensive, simple, and durable; and the prepayment meters are ready to hand, and as well adapted to their purpose as any appliance of the kind can be expected to be. When the cottager has obtained his gas in this manner, it can easily be made useful in many ways. It will light his room, and on raw early mornings and late evenings will take the chill off also —thus saving a good many fire-lightings. Moreover, the convenience of a simple boiling-ring, or a neat little gas-cooker, is in many instances a greater inducement to the cottager than even lighting.

What are the corresponding inducements to the humble householder to take up prepaid electric lighting? Granting to the incandescent electric lamp all that its partisans claim for it—that it is clean, cool, and healthful as compared with any light of combustion, and that it is particularly suitable for reading in bed—do these recommendations go far to compensate for the fragility of the lamp itself, its limited application to lighting only, its calculated dimness, and its incontestable costliness? Disguise the fact as they may, deny it as boldly as they dare, electricians know full well that everything about their system of lighting—current, fittings, meter—costs not less than three times more than the equivalent service of gas. The Gaslight and Coke Company have a suspense account amounting to just upon a quarter of a million sterling representing the outlay upon the prepayment meter branch of their business. If it were a case of electricity supply by the same system, the amount would be three-quarters of a million. We cannot see that the new electric wiring speculations possess the means of doing anything like such a trade.

And upon the top of these "free wiring" proposals there comes a new set of wiring rules, issued by the Institution of Electrical Engineers. These are published in full in the current number of the "Electrician." They are declared to embody the chief precautions and requirements which the Institution considers necessary to secure satisfactory results. The description is doubtless accurate. "They are arranged in such a form that they may be used as a specification of requirements and precautions which must be strictly enforced if a user of electrical energy wishes to have his house or premises supplied in such a manner that he may be as free as possible from risk of fire, of extinction, failure of supply, or danger to person, and at the same time have his work carried out with due regard for economy in first cost and in after cost of maintenance. The rules are framed to meet all ordinary cases, but they are not intended to take the place of detailed specifications drawn up by consulting engineers to meet individual requirements." It is not for us to criticize these rules, which are very explicit, and not a little instructive, on the various conditions of safety and efficiency to be satisfied. Take the question of temperature limits. The wires "should be of such size that, when the maximum current is passing continuously through them, their temperature shall not exceed 130° Fahr. It will, however, generally be found that, if the conductors are worked up to a density of current corresponding to this increase of temperature, the resulting fall of potential or drop in volts will be inconvenient and uneconomical. It is imperative that this temperature of 130° Fahr. should never be exceeded, and therefore it is necessary to take into account the maximum temperature to which they may be subjected, independently of electric heating, in each particular locality; and the greatest increments above this temperature should not be more than will raise them to a temperature of 130° Fahr. If the maximum temperature of the British Islands be taken as 100° Fahr., then the increment due to electric heating must not exceed 30° Fahr.—that is to say, the size of the wires should be such that, when carrying the maximum current continuously for many hours, the temperature does not rise more than 30° Fahr. above the temperature, for the time being, of the place in which they are situated." This passage reminds one of the legend told of the early days of gas lighting, when legislators and others could with difficulty be persuaded that gas-pipes supplying a flame were not actually hot. It is worthy of notice that, according to these rules, "the use of combined gas and electric fittings should not be permitted. Where gas-fittings are adopted, they should be insulated from the gas-pipe." It is observed by the "Electrician" that, besides these new rules and the regulations laid down by various supply companies and municipalities, there are at least three sets of fire insurance companies' wiring rules in force in this country. Electric wiring ought to be safe, if rules are good for anything, whatever effect the regulations may have upon the cost of the work.

The Metropolis Water Act, 1897, which comes into operation on the 1st prox., has been issued.

THE ESTIMATION OF OXYGEN IN COAL GAS.

The introduction of continuous revivification of oxide of iron or Weldon Mud by means of the addition to the gas entering the purifiers of a small proportion of air or pure oxygen, has incidentally emphasized the want of a rapid and exact method of estimating small amounts of oxygen in a gaseous mixture. Gas burettes of 100 c.c. capacity which are common to most forms of gas analysis apparatus for works' use, are comparatively valueless for the determination of minor constituents. In such apparatus, water is usually the confining liquid, and the error of observation is not less than 0·2 c.c. Since the quantity of oxygen in coal gas is seldom as much as 1 per cent., even when continuous revivification is practised, an error of 0·2 per cent. in an estimation assumes great magnitude. Owing to the inexactness of the common volumetric methods of analysis, continuous revivification goes on in many large works without further control than the comparison, at intervals, of the readings of the air-meter at the inlet of the oxide purifiers with the readings of the station gas-meter. The amount of air pumped into the gas is regulated accordingly, and if the apparatus is in proper working order and under efficient and intelligent superintendence, purification and revivification will proceed satisfactorily. But very often an appeal to analysis for the purpose of ascertaining the precise proportion of oxygen at the inlet or outlet of one of the purifying vessels, would be resorted to by the gas manager in cases of doubt, were it not that the analytical methods for determining small amounts of oxygen are either tedious or inexact.

In continuous revivification by means of air, the admission of more air than is necessary to supply the oxygen required for the revivification is fatal to economical working, because the nitrogen of the air lowers the illuminating power of the gas, and the cost of maintaining this by enrichment becomes increased. A small excess of air may thus indirectly completely nullify the direct economy gained by revivification *in situ*. It has been computed from experimental data that 1 per cent. of nitrogen in ordinary coal gas diminishes by 0·4 candle the illuminating power of the gas when burnt in an argand. In air, 1 volume of nitrogen is associated with only about 0·25 volume of oxygen; and the error in an ordinary works' method of estimating oxygen may, as already stated, amount to at least 0·2 per cent. of the total volume. An oxygen determination is frequently used as an indirect method of determining nitrogen derived from air; and then the error in the oxygen determination when transferred to the nitrogen becomes magnified four times, and nearly equals 1 per cent. of the total volume of gas. This percentage of nitrogen adversely affects the illuminating power of gas to the extent of 0·4 candle. The gas manager recognizes that oxygen and indirect nitrogen determinations are subject to so great an error; and therefore he prefers to depend solely on the air and gas meter-readings for control of the revivification process.

The case of continuous revivification is but one of many in which a more exact method of readily determining oxygen—and thereby air—in gas would be invaluable to a manager. The free nitrogen derived from the coal itself probably seldom exceeds 2 per cent. of the coal gas; yet the gas as distributed generally contains from 5 to 10 per cent. of nitrogen. In London and many large towns, a portion of this nitrogen has undoubtedly been admitted intentionally for the sake of the oxygen associated with it in the air. The value of the oxygen in purification has been computed, and found to outweigh the loss of illuminating power due to the nitrogen. But over and above the amount thus intentionally admitted, more nitrogen is often found; and in works where air is not used in purification, the surplus nitrogen is still found. In many cases it is derived from leaks, by which air is admitted to the gas on the vacuum side of the exhauster; and they generally pass undetected and unsuspected until they admit so much air that a burning jet of the gas is visibly enfeebled. In some works, it is to be feared that a considerable in-draught of air is a normal occurrence; and numerous complaints of bad gas and heavy enriching accounts arise therefrom. In other works, where an attempt is made to reduce the amount of carbon bisulphide in the gas, how often is the so-called "fickle" behaviour of a sulphide vessel due to the disturbing effect of oxygen in air unintentionally admitted to the gas? Those who have investigated such cases by the aid of analyses of both gas and materials will reply, "Very often." In fact, 0·2 per cent. of oxygen in the gas may be of great service in the oxide vessels, but may do immense mischief in the sulphided lime vessels. Yet the limit of error in oxygen determinations by the methods hitherto in vogue is not overstated as 0·2 per cent. of the gas under analysis. In the manufacture of water-gas also, and in the production of oxy-oil gas, as well as in many other instances, a rapid method of more accurately determining oxygen would be of the greatest utility.

Dr. Otto Pfeiffer, of Magdeburg, claims to have elaborated such a method, and has described his procedure in a recent number of the "Journal für Gasbeleuchtung." He failed in his attempts to devise a satisfactory titration method; and he also found that the oxidation of indigo white to indigo blue proceeded too slowly, and was too incomplete, to form the basis of a system. After many fruitless researches with other reagents, he returned to the well-known absorbent of oxygen, an alkaline solution of pyrogallol; and he contented himself with applying

it after a new fashion. Most gas analysts will have observed that pyrogallol—often known as pyrogallic acid, or in the *argot* of the photographer as "pyro"—could be used as a reagent for the qualitative detection of oxygen in gas merely by the colour-change its alkaline solution undergoes on the absorption of oxygen. Dr. Pfeiffer uses the well-known Bunte gas-burette for both the qualitative and the quantitative analysis. For the former, he takes about 100 c.c. of the gas into the burette, and then, while the upper stopcock remains closed, withdraws the water through the lower cock until it occupies only the capillary of the latter. Through this cock he admits about 5 c.c. of strong solution of caustic potash; and then he washes, by means of 2 to 3 c.c. of oxygen-free water, about 0·2 gramme of pyrogallol from the funnel into the burette. If, after agitation, the liquid in the burette remains colourless, the gas is free from oxygen; and even a faint violet tinge may be caused merely by oxygen in the potash solution. But if 1 per cent. of air is in the gas, the liquid becomes at once coloured yellowish brown, owing to the formation of galloflavin. Even if only 0·25 per cent. of air is present, the liquid shows the reaction within five minutes. The depth of the tint varies with the quantity of oxygen; and upon this fact Dr. Pfeiffer's quantitative method rests.

He observed: (1) The absorption of oxygen is complete after five minutes' agitation if the specified quantities of reagents are used; (2) the galloflavin coloration darkens subsequently, and then gradually becomes weaker: (3) the colour produced is independent of ordinary variations of temperature; (4) it varies, however, with the quantities of the reagents used; (5) it has a burgundy-red shade if sulphuretted hydrogen is present. He was guided by these observations in working out his method of estimation, which is as follows: 100 c.c. of the gas is taken in the burette, and the water is sucked out, and about 5 c.c. of solution of caustic potash (1 of potash to 2 of water) admitted through the lower stopcock. The quantity admitted may be fixed once for all by means of a file-mark on the burette. Then 0·2 gramme of pyrogallol is put into the funnel; 2 c.c. of water is added; and the solution thus formed is run into the burette, with the exception of one drop which closes the orifice of the capillary. Then by agitation of the burette for five minutes the oxygen is absorbed, and oxygen-free water is passed up until the liquid in the burette stands at the zero mark. After two minutes' rest, the colour of the liquid is compared with that produced by the addition, drop by drop, of a solution of caramel to water in a test-glass. The number of drops of caramel solution required to produce the tint of the liquid in the burette is noted; and from the number required, the percentage of oxygen in the gas is known from empirical results previously tabulated.

The caramel solution used for the production of the tint is made in the following manner: 30 grammes of cane sugar are dissolved in 1 litre of boiling water; then 30 c.c. of sulphuric acid (1 of acid to 3 of water) are added, and the solution is boiled for 15 minutes. Then 85 c.c. of solution of caustic soda (sp. gr. 1·30) are gradually added. From 30 to 35 c.c. merely serve to neutralize the acid; but as the remainder is added, the liquid becomes of a brownish-red colour. It is boiled for 15 minutes, and is not afterwards liable to change of colour provided it is stored in the dark. Its tone is precisely that of galloflavin. The titration value of the solution is ascertained by using it for the production, in the manner already described, of the tint furnished in alkaline solution of pyrogallol by artificially prepared gaseous mixtures containing known percentages of air or oxygen. The liquid in the Bunte burette is brought up to the zero mark by admission of water, as described above; and the caramel solution is then run drop by drop from a burette into 10 c.c. of water in a test-glass. The number of drops of caramel solution required to produce the right tint of liquid in the Bunte burette is noted, and set against the percentage of oxygen in the gaseous mixture.

Observations are made with gaseous mixtures containing different, but known, percentages of oxygen; and then by interpolation the percentage of oxygen corresponding to any given number of drops of caramel solution is ascertained. The effect of one drop of the solution is clearly detected by the sight. The observations should be made two minutes after the cessation of the agitation of the Bunte burette. The pyrogallol solution continues to darken for at least ten miuutes; but time is saved if the titration is invariably made two minutes after the agitation is finished. The values found by Dr. Pfeiffer under these conditions for one preparation of standard caramel solution were: Percentage of air in the gas, 0·5, 1, 2, 3; number of drops of caramel solution required, 4, 11, 33, 66. The percentages of air corresponding to numbers of drops of caramel solution intermediate between the foregoing may be conveniently found by plotting the above values as ordinates and abscissæ, and thus obtaining a curve passing through the intermediate points. If the values are in the first instance ascertained against air, the conversion to percentages of oxygen is effected by multiplying by 0·21. It is more convenient to use air than undiluted oxygen for the preparation of the gaseous mixtures used for standardizing the caramel solution. These mixtures are best prepared in the burette itself, by admitting through the lateral way of the three-way cock a given volume of air from a measuring pipette to about 100 c.c. of gas free from oxygen in the burette. After the caramel solution has been carefully standardized, estimations of small percentages of oxygen or air in gas may be rapidly and accurately made.

The water used to bring up the liquid in the gas burette to the zero mark may contain in solution oxygen sufficient to show 0·1 per cent. on the gas under analysis. This amount would be nearly constant in all the estimations, and therefore would not affect the comparative results. But if for any reason it is considered desirable to eliminate this nearly constant error, water deprived of oxygen should be used. A convenient test for oxygen in water is the following: About 20 c.c. of the water in question is added to the potash solution which clings to the sides of a test-tube when the latter is inverted after containing some solution of potash. Then two or three drops of solution of manganous chloride are quickly added, and a precipitate is thus produced. If the water is free from oxygen, the precipitate (of manganous hydrate) will be perfectly white; but if it contains oxygen, the precipitate (of manganic hydrate) will be brown.

Water free from oxygen may be produced by boiling ordinary water for 1½ minutes in a test-tube. Larger quantities boiled in flasks contain traces of oxygen even after boiling for 45 minutes. Oxygen-free water may also be produced by putting yellow phosphorus into a completely filled flask of water; but the water thus deprived of oxygen retains an odour of phosphorus. Water is perhaps most conveniently deprived of oxygen for the purposes of gas analysis by means of zinc. The zinc may be rendered specially active by immersion for 15 minutes in water to which a few drops of solution of copper sulphate have been added. It is then washed with water, and put into a 500 c.c. Woulff's bottle. One tube of the bottle reaches nearly to the base, and has its end within the bottle protected by a pad of cotton wool. The external end of the tube has attached to it a piece of flexible tubing provided with a pinch-cock. The other tubulure of the bottle has a stopper with two perforations, one of which takes a tube ending below flush with the stopper, and above in a piece of flexible tubing closed by a glass rod. The other perforation accommodates a tube which passes a little distance within the bottle. After the bottle has been filled with water saturated with coal gas, and bubbles of gas and air have been detached from the zinc by shaking, this tube is connected to the water reservoir of the Bunte apparatus, and the Woulff's bottle is thus put under pressure. The gas collected in the top of the bottle is allowed to escape through the short tube by temporary removal of the glass rod. After some hours' rest, the water in the bottle will be free from oxygen, and may be drawn away through the long tube as required for use. The pad of cotton wool prevents particles of zinc passing out with the water. As water is removed for use, it is replaced from the pressure reservoir; and thus a continuous supply of oxygen-free water may be obtained in quantity sufficient for the estimation of oxygen by the method described above.

A Proposed National Physical Laboratory.—A small Committee has been appointed by the Treasury "to consider and report upon the desirability of establishing a National Physical Laboratory for the testing and verification of instruments for physical investigation, for the construction and preservation of standards of measurement, and for the systematic determination of physical constants and numerical data useful for scientific and industrial purposes, and to report whether the work of such an institution, if established, could be associated with any testing or standardizing work already performed wholly or partly at the public cost." Lord Rayleigh, F.R.S., has been nominated Chairman of the Committee.

The Coal Boring in Kent.—"If promising beginnings could always be regarded as the certain forerunners of successful endings," says the "Engineer," "then there would be a boom in coal in store for the county of Kent and its neighbourhood. The sinking of a pair of shafts, from the bottom of which borings were made to a total depth of over 2200 feet, have revealed the existence of seams of coal with a total thickness of 23 feet. . . . It has been stated that some of the fossils brought up from one of the shafts have been identified by well-known geological experts as belonging exclusively to the superior strata of productive coal-beds. This circumstance would appear to favour the probability that at some further depth, about a couple of thousand feet below the present lowest level, not only would a much greater quantity of coal be found, but the seams also would be of a greater thickness."

The Toronto Meeting of the British Association.—To-morrow the British Association will open their annual meeting in Toronto. This is only the second occasion on which the members have met beyond the limits of the British Islands; the previous one being the gathering in Montreal thirteen years ago. The President is Sir J. Evans, K.C.B.; and his address will deal mainly with the antiquity of man. There are full programmes in all the ten sections, though there is a paucity of subjects specially interesting to our readers. Professor A. R. Forsyth, F.R.S., of Cambridge, will preside over the Mathematics and Physics Section; Professor W. Ramsay over that devoted to Chemistry, in which a paper by Professor Harold B. Dixon, F.R.S., on "Explosion Flames," will be read; Professor E. K. Gouner is President of the Economic Science Section; and Mr. G. F. Deacon, M.Inst.C.E., will occupy a similar position in the Mechanical Science Section. In his address, Mr. Deacon is expected to deal at some length with the subject of the training of engineers. There will be the usual public lectures—one being to working men.

PERSONAL.

Mr. A. SHIRES, formerly of Kidsgrove, has been appointed Manager of the Baslow Gas-Works.

Mr. J. PATERSON, of Hamilton, has left that town to take charge of the gas-works at Carrick-on-Suir.

Mr. F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E., has succeeded the late Mr. Frank Mead as Consulting Engineer of the Leatherhead Gas Company.

The personalty of the late Mr. RICHARD CHRIMES, of Rotherham, whose will has been proved by his widow and sole executrix, amounts to £100,052 gross and £90,333 net.

The will of Mr. VITRUVIUS WYATT, whose death was recorded in the "JOURNAL" for the 27th ult., has been proved. The personalty is sworn at £26,044 gross and £25,944 net.

The vacancy caused at the Bloom Street works of the Salford Corporation by the recent death of Mr. E. T. Haddy has been filled by the appointment of Mr. T. OUSEY, of Stalybridge.

The satisfaction of the shareholders of the Rochester Gas Company at the way in which Mr. J. M. VEEVERS has discharged the duties of Secretary and Manager was tangibly expressed on the occasion of their last half-yearly meeting by granting him an increase of £100 per annum in his salary.

For some time past, a movement has been on foot to present a testimonial to Mr. H. ROKEBY PRICE, who has retired from the chairmanship of the Committee of the Stock Exchange. The testimonial has taken the form of a pair of silver salvers and a silver bowl, suitably inscribed, a diamond necklet and a diamond ring; and it was presented a few days since. The event calls for notice here on account of Mr. Price's connection with several gas and water undertakings. He is Chairman of the Leatherhead and District Water Company and a Director of the Colne Valley Water Company.

Mr. B. A. LEWIS, the Manager of the Carmarthen Gas-Works, has lately shown that in addition to his professional knowledge, he possesses artistic ability of a high order. At the recent National Eisteddfod at Newport, he was awarded the first prize for six pen-and-ink sketches of Welsh scenery, which called forth some laudatory remarks from Professor Herkomer, the adjudicator. In the competition in water colours, this eminent artist highly commended Mr. Lewis's picture entitled "The Coracle Fishers of the Towy," which was sold at the Eisteddfod. Mr. Lewis has just taken an art master's certificate at the Carmarthen School of Art.

OBITUARY.

The death is announced of Mr. W. ANGEL, Engineer at the Warminster Water-Works.

The death took place last Thursday of Mr. E. BOTTLE, who was for many years Deputy-Chairman of the Dover Gas Company. The deceased, who was 81 years of age, had had a highly prosperous business career.

We regret to record the death of Mr. W. WELLER, of Egham, in the 69th year of his age. Deceased had been for many years associated with Egham in all matters connected with local government; and he was a Director of the Staines and Egham Gas Company.

Dr. EDWARD DAVIES, who was the last survivor of the Directors of the Wrexham Water Company elected on the formation of the concern in 1864, died on the 6th inst. At the general meeting of the shareholders last Tuesday, the chair which would have been occupied by Dr. Davies, as Deputy-Chairman, was left vacant.

The death is announced of Mr. A. H. V. NEWTON, M.Inst.C.E., F.C.S., the Deputy-Engineer at the Bombay Water-Works. Deceased was the fourth son of the late Mr. W. E. Newton, of Chancery Lane; and he formerly held the position of Assistant Municipal Engineer at Singapore. He died of cholera in Bombay on the 27th ult., at the early age of 45.

We regret to record the death of Mr. G. GRIPPER, J.P., the Chairman of the Tottenham and Edmonton Gas Company. Mr. Gripper was for many years a Director of the Company; and had held the chairmanship since 1887. At the second half-yearly meeting of the Company the preceding year, the then Chairman (Dr. Brickwell) was unable to preside; and he shortly afterwards resigned. The Deputy-Chairman (Mr. J. Malcolm) being undesirous of taking the vacant position, Mr. Gripper was selected to fill it. He was prevented, by an affection of the foot, from being in his usual place at the last meeting, when his duties were discharged by the present Deputy-Chairman (Mr. Corbet Woodall). Deceased was in his 78th year.

The death occurred at Devonport on the 4th inst., at the age of 87 years, of Mr. THOMAS HAWKER, who until recently was a Director of the Devonport Gas Company. He was admitted as a solicitor in 1837, and practised for many years. At one of the parliamentary elections for the borough of Devonport, he was acting as agent for the Conservatives; and one of the candidates—a Mr. Ferrand—paid eloquent tribute to Mr. Hawker's good qualities when he left in his will £100 "for honest Tom Hawker." Mr. Hawker joined the directorate of the Gas Company sixteen years ago, and retired from the position at the annual meeting a few weeks since. He is the fourth Director of the Company whose death has taken place this year.

By the recent death, in his 58th year, of Mr. W. SPILLANE, D.L., the Manager of the Limerick Corporation Gas-Works, there has been removed from the public life of the city one who had for some years figured conspicuously in it. When quite a young man, he became a member of the Corporation, and a few years later was elected Mayor. In 1872 he filled the office of High Sheriff; and from that year till his death his connection with public affairs remained undiminished. He was a Governor of the Lunatic Asylum, the oldest member of the Harbour Board, a Market Trustee, an *ex officio* Guardian of the Limerick Union, and a Magistrate for the city and county; and a few years since he was appointed a Deputy-Lieutenant for the city. Mr. Spillane had been connected with the management of the gas undertaking of the Corporation for more than a quarter of a century. The works of the Limerick Gas Consumers' Company were acquired by the Corporation in 1856; and their management was in the hands of a Committee, of which Mr. Spillane was a member, down to 1875, when he was appointed Manager. The following year, there was an investigation into the position of the concern by a Government Commission appointed to inquire into the Nature and Management of Corporate Property in Ireland; and the result was some curious revelations into which it is not needful to enter here. The Corporation were then supplying the city in competition with the United General Gas Company; but they obtained an Act in 1878 to authorize the purchase of the Company's works for a sum of £26,000 in cash. Under Mr. Spillane's management, the united concern has prospered; and we understand that if he had lived only a few years longer he would have seen the loan of £20,000 completely paid off, and the works the property of the citizens. At a recent meeting of the Harbour Commissioners, Mr. Power, in moving a vote of condolence with Mrs. Spillane and the family, remarked of their deceased colleague that he was "upright, fearless, and able in the performance of his duty, in the carrying out of which he knew neither friend nor foe. His death was a loss to the whole community." It should be mentioned that Mr. Spillane was ably assisted in the financial branch of his work by the Secretary (Mr. Alfred Baker).

The Scotch Oil Trade.—It is reported from Glasgow that the Scotch oil trade combination has practically collapsed, owing to the decision of the various companies not to fix prices for next winter for burning oils, &c. The companies will therefore act independently.

The New Issue of Stock by The Gaslight and Coke Company.—The new issue of ordinary "A" stock of The Gaslight and Coke Company, referred to by the Governor (Colonel Makins) at the last half-yearly meeting, was submitted to public competition, in accordance with the announcement which has appeared in our advertisement columns, at the Mart, Tokenhouse Yard, E.C., on Monday, the 9th inst., by Mr. Alfred Richards. The standard dividend on this class of stock is 10 per cent. per annum, subject to the sliding-scale; but the last was at the rate of 12¾ per cent. per annum. The amount offered—£25,000—was all sold at an average price of £306 19s. 2d. per £100 of stock; the sum realized being £76,740.

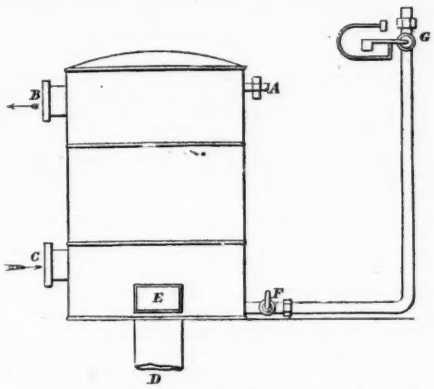
Gas-Engines for Traction Purposes.—Gas-engines are steadily coming more to the front in America. One is described in the "Street Railway Review," that is driving the power plant of the Traction Company of Lancaster, Ohio. The Company work from three to five cars over four miles of line with some 8 per cent. grades. It is known as the American Kilmarnock, being a single-cylinder double-acting engine; and it develops 130 indicated, or 110 brake horse power; its rated size being 100-horse power. The speed is 180 revolutions a minute; and it drives an 80 kilowatt Thomson-Houston six-pole generator. The engine has a porcelain ignition-tube, and uses natural gas under high pressure. The consumption is 16 feet per brake horse power.

Mr. W. C. Peebles's Remarks at the North British Association Meeting.—We regret that a little confusion arose in reporting the remarks of Mr. W. C. Peebles at the recent meeting of the North British Association of Gas Managers, as given in the "JOURNAL" last week. On p. 319, col. 2, the report should have read as follows: "A man would be putting in an engine without knowing what size he wanted; and he might say: 'Nominally, I want 10-horse power.' But the engine would really give out not 10 but 20 horse power. This was again misleading, because they had the *indicated* horse power, the power which the engine actually received from the gas, and they had the *brake* horse power, which was the power given out by the engine, or the power which was available for the driving of the machinery. He was sorry that Mr. Pooley had stated that the gas required per nominal horse power was 20·31 cubic feet. He was rather afraid this was a mistake, because it brought the amount down to about 10·31 cubic feet, for the brake horse power was double the *nominal* horse power. Some makers reckoned the nominal horse power at half the indicated, and some at half the brake horse power. It was quite a confusing term. He said that people should do away with the term 'nominal horse power.'" On the following page, col. 1, line 4, the sentence should have read: "In ordinary working, he did not think there was any engine, doing actual work, which would go beyond that, *on so small a quantity*"—*i.e.*, 13·54 cubic feet.

NOTES.

Greenhouse Heating by Gas.

M. Garnier described to the members of the Société Technique du Gaz en France, at their last meeting, his system of heating greenhouses by gas. The novelty, and at the same time the advantage, of the arrangement lies in this—that gas is only consumed when it is absolutely required for the maintenance of the temperature, and it can be raised and lowered automatically. The appliance is shown in the accompanying illustration. It is of the thermo-syphon type, and it can be connected with the piping previously used for other combustibles. The cold water is introduced at A with the help of a float-cock, by which a constant level is maintained. In order to become heated, the water passes over to the tubulure B, and enters the piping in



which it is to circulate. It then returns to the tubulure C, and re-enters the heater, where its temperature is once more raised. The heat is furnished by a series of Manchester burners, lighted at the orifice E, which are lowered to a jet when the temperature indicated by the thermometer is sufficient, but become larger when the mercury falls. This is the practical and at the same time interesting part of the arrangement, and its chief feature is the automatic regulating tap G, which is unlike anything hitherto employed in such a connection. The action of this tap has been found, as the result of numerous experiments, to be thoroughly reliable. The gas supply is shut off by the cock F; and the waste gases escape at D. The body of the heater is 2 feet high and 16 inches in diameter.

Ventilation of the Park Hospital.

The Park Hospital, Hither Green, recently opened by the Prince and Princess of Wales, is regarded as the best example of the application of modern sanitary science to a building devoted to the reception of persons suffering from infectious disease. The Architect is Mr. Edwin T. Hall. The heating arrangements of the wards are a combination of warm air supply with open fireplaces. The hot-water radiators are placed in cases situated in front of the windows; the fresh-air inlets being made adjustable to suit the weather conditions. The fireplaces are built in separate square stacks, situated in the middle of the ward, and having a fire-grate on every face. The four smoke-flues are surrounded by air-aspirating flues, which draw off the heated and vitiated air from the centre of the ward, at ceiling level. These stacks have during construction proved a special object of study for a large number of architects and public officers, and their arrangement is one of great interest, as indicating a deliberate preference for what is called the "natural" as distinguished from the mechanical principle of ventilation. The engineering arrangements of the hospital were supervised, in conjunction with the Architect, by Mr. E. R. Dolby. The kitchen walls are faced with glass internally, and the cooking is done by steam and gas.

Failure of Reservoirs in America.

Early last month, news reached this country of the failure of two earthen dams, having masonry heart walls, erected at Melzingah by the Fishkill and Matteawan Water Company. According to particulars which have appeared in "Engineering," the dams were comparatively small, and were located one above the other on a mountain stream. The upper reservoir had a capacity of 8 million gallons, while the lower was equal to impounding 64 million gallons. The upper dam was 340 feet long and 28 feet high; the lower one being 400 feet long and 34 feet high. In each case there was a masonry heart wall 3 feet thick at the bottom, tapering to 1 foot or 1 ft. 6 in. at the top, and carried up to within 1 foot of the top of the bank. This wall was backed with earth on each side; the upper slope being covered with stone pitching. The earthwork in the case of the lower dam had been somewhat carelessly put in place; but with the upper one greater attention had been paid to securing good work. The bye-wash of the upper dam was 47 feet long, and its crest lay 1 ft. 6 in. below the top of the bank; while in the case of the lower dam, the bye-wash was 75 feet long and 18 inches deep. Our contemporary thinks this small difference between the levels of the top of the banks and the crests of the overflow weirs is perhaps the point most to be criticized, especially as a certain settlement of the main bank had occurred in each case—further reducing the margin of safety. The failure arose through the upper bank being topped by a flood, though on the day of the accident the water-level in the reservoir had been 7 ft. 6 in. below the crest of the upper overflow weir, and the rainfall recorded in the neighbouring meteorological stations was by no means extraordinary. Apparently, however, there must have been a local fall of very great intensity, which rapidly filled the reservoir, and which the bye-wash proved inadequate to carry off. Once the bank was topped, the dam soon gave way; and the flood passing down, of course, carried away the lower bank, which nothing could then have saved. The question arises as to how far engineers will be justified in providing for excessive local falls, such as occurred in this instance. The danger is evidently greater in the case of small impounding reservoirs drawing their supply from a gathering-ground of limited extent. When this is extensive, a heavy local fall is averaged, and the danger disappears.

The Skin-Friction of Water in Pipes.

Some interesting and instructive experiments designed to elucidate the subject of the skin-friction of fluids against solid substances, as in the motion of water through pipes, have been carried out by Professor H. S. Hele-Shaw at University College, Liverpool. The great difficulty was to find something to mix with the currents of water to show, by the aid of the lantern, what was going on. Colouring matter may be used at very low velocities; but where the flow of water is at anything like practical rates, this is quite useless, as the colour immediately mixes with the body of the water. It was only by accident that what has turned out to be the most successful arrangement was discovered. An experiment was being made with the section of a pipe with only clear water, when it was observed to show perfect stream lines upon the projection screen, which was traceable to an accidental intrusion of air bubbles. The presence of air does not affect the movement of the water. The result of numerous experiments and observations was that there is a border region between water in motion and the containing pipe, which represents a condition of parallel flow of layers of water past the skin of the sides of the pipe. Here a state of shearing exists, while immediately outside it the water is in a condition of sinuous motion, which corresponds to the state of the higher velocity of water. The part played by the viscosity of water in resisting the delivery of the fluid through pipes when the velocity is increased beyond a certain critical point has been investigated by Professor Osborne Reynolds; and Professor Hele-Shaw's experiments, which are being continued, so far show that the change from a steady flow to the condition of eddying or sinuous motion in which a large proportion of the power is absorbed, occurs very suddenly. There does not appear to be any possibility of curing this by any process of lubrication of the surface, as many inventors have suggested; for if once the inside of the pipe is wet, the shearing action at this wetted surface must result, at certain speeds, in setting up eddying or sinuous motion in the surrounding water.

Dr. Voelcker on Nitrogenous Manures.

A general description of the Woburn experimental farm, by Dr. Voelcker, appears in the Journal of the Royal Agricultural Society. This farm has been placed at the disposal of the Society for the last twenty years, by the generosity of successive Dukes of Bedford, for investigations into the growth of farm crops and the feeding of stock. The experience gathered in this period differs in many respects from the preconceived notions of agriculturists. With regard to the action of manures upon the soil and its crops, some remarkable observations have been made. Dr. Voelcker finds that if land be kept clean, it may continue to produce moderate crops of wheat and barley for a number of years, without manuring. It is useless to apply mineral manures alone for either wheat or barley. Nitrogenous salts, such as sulphate of ammonia and nitrate of soda, have a great influence upon both wheat and barley crops. This is especially marked with barley. Still, nitrogenous manures are not good for use alone, as the crop is not healthy; and the result of the continuous application of such salts is to deprive the soil of its mineral ingredients, more particularly the lime. The proper manuring for such crops is the application of mineral manures along with moderate amounts of nitrogenous manures. Minerals are essential, though not efficacious by themselves. The quantity of nitrogenous salts which it will pay to apply to land along with minerals depends upon current market prices. As a rule, it is not safe to use more than that which yields 50 lbs. of ammonia to the acre—say, 2 cwt. of sulphate of ammonia or 2¼ cwt. of nitrate of soda per acre. The choice between the sulphate and the nitrate is mainly a matter of the season and the relative price. In a wet season, sulphate of ammonia does better for wheat. But over a number of seasons there is little to choose between the two salts; and the one that gives the cheaper nitrogen is the one to use. If nitrogen costs the same in each, then sulphate for wheat and nitrate for barley should be the choice. Farmyard manure is not equal to minerals and nitrogenous salts, though the land will bear more of it. Practically, all nitrogenous salts, even with free addition of minerals, only last for the year of their application.

TECHNICAL RECORD.

NORTH OF IRELAND ASSOCIATION OF GAS MANAGERS.

Annual Meeting at Omagh.

The Annual Meeting of the North of Ireland Association of Gas Managers was held in the Grand Jury Room in the Court House, Omagh, on Tuesday last. There was a very gratifying attendance, which is all the more creditable to the members of the Association, seeing that the place of meeting was, to many of them, very much out of the way. In justice, however, to the Association, it must be said that the reason for the selection of Omagh as the place of meeting was one which illustrates, in the happiest manner possible, the high state of good feeling which prevails among the members of the Association—it being that they might do honour to their senior member, Mr. D. M'Callum, of Omagh. Mr. M'Callum's age cannot, perhaps, be exactly stated; but an indication of it is to be found in the fact that he has been gas manager at Omagh "from time immemorial" as the lawyers say when they mean that no one who is accessible can recollect when it was not.

Notwithstanding his great age, Mr. M'Callum has kept himself abreast of the times, in all matters relating to gas manufacture and distribution. He has under his charge a neat and tidy little works, equal to a maximum daily make of 60,000 cubic feet, and having an annual output of 17½ million cubic feet. If they are not, in all departments, of modern style, the reason is not that Mr. M'Callum is unaware of the advantages of modern appliances, but that a manager in his position cannot afford to renew any part of his plant before the time when the step becomes really a necessity, and then the improvement can be made. The works at Omagh were open to the inspection of the members of the Association, most of whom took advantage of the privilege. The retort-house is one of the weakest parts of the whole place; but even in it Mr. M'Callum has done what he can to get the best results out of somewhat antiquated arrangements. Though the system of firing is of the old direct order, he has—in the construction of his furnaces, and in the species of furnace bars which he uses—made special provision for the keeping of the air supply as ample as possible, thereby securing the maximum of heating power out of the fuel. There are five settings of three retorts each. The hydraulic main is led through the gable wall; and on the end of it, flush with the outer side of the wall, is a valve which Mr. M'Callum himself has patented. In this valve there is an adjustable diaphragm, which is so arranged that all the condensed liquids in the main must go below it. This prevents tar being left in the main, but if it were necessary to clean out the main, the valve is lowered, the trap taken off, and the whole main, 18 inches in depth, is open. There are four annular condensers, and beside them is a very neat arrangement of tar and liquor receiving apparatus, including a pump which, as well as the exhauster, situated in a building adjoining, is driven by a 5-horse power vertical gas-engine. The gas is treated in a tower scrubber, and then passes to the purifiers, of which there are four, each 8 feet square. Finally it is registered at the station meter. The other weak point in the plant is the gas-holder capacity. There are three holders, of a total capacity of only 32,000 cubic feet, or equal to barely one-half of the maximum day consumption. The deficiency, however, is not due to want of interest or understanding on the part of the Directors of the Company of the necessities of the undertaking, but, it is understood, is the result of a misunderstanding as to the ownership of the site upon which a new holder is proposed to be erected. Everywhere in the works the greatest cleanliness and tidiness prevailed; and all the parts had the appearance of its being the habit to attend to their upkeep with the most scrupulous care.

The meeting opened shortly before mid-day—Mr. J. NISBET, of Portadown, the Vice-President, occupied the chair; the President, Mr. M. Martin, of Drogheda, not feeling himself quite able to undertake the duties.

WELCOME TO THE ASSOCIATION.

Dr. FLEMING, one of the Directors of the Omagh Gas Company, asked to be allowed on their behalf to give the Association a very hearty welcome to Omagh. He hoped the members would have not only an enjoyable, but also a profitable and successful meeting. He, as representing the Directors and shareholders of the Gas Company, could not but look with every kind of favour upon Associations of this kind, because he was sure they promoted the members' own knowledge and efficiency, as well as assisted them in watching over the interests of their several undertakings. He was sure they could not be very prosperous gas managers if they were connected with failing and unprosperous companies; and, of course, the success of the companies was very largely dependent upon them. He therefore thought these meetings were extremely desirable, in enlarging their knowledge of the various things that tended to promote the prosperity of gas undertakings. Then there were those who were inimical to them—who were their enemies, so to speak—in the shape of promoters of electricity, acetylene gas, and half-a-dozen other schemes with which they were threatened now-a-days. There were some continually saying that the Omagh Gas Company would soon be extinct, and that they would have various new lights. Anyhow, the Omagh Gas Company had—thanks to their worthy Manager, Mr. M'Callum—been on the whole, a very prosperous concern; and they trusted it would long continue, aided by the efforts of such gentlemen as those gathered before him.

The CHAIRMAN said he was sure they were all much indebted to Dr. Fleming and the Directors of the Omagh Gas Company for the welcome which had been accorded to them.

REPORT AND ACCOUNTS.

The HON. SECRETARY (Mr. J. Whimster, of Armagh) read the report of the Committee. They commenced by expressing their regret at the loss sustained by the Association by the death of Mr. P. J. Salmon, of Galway, one of the most popular members of the Association, who had been identified with it since 1890; but before the founding of it he endeavoured, unsuccessfully, to secure the establishment of an Irish Association. The Committee sent a letter of sympathy, together with a cheque for £10, to his widow and family, as a tribute of the respect and esteem in which he was held. In the course of the year Mr. Shimeld, one of the extraordinary members of the Association, had also been removed by death. At the meeting in Holywood last year, it was decided to offer medals for the best papers to be presented at the annual meetings; and the Committee issued to the members a circular setting forth the conditions. The Committee regretted to state that, in response to their invitation, only one paper had been sent in. Under these circumstances, there was no competition; but the Committee thought the gold medal should be given to the writer of the paper. The members were invited to express their approval or otherwise of the conditions laid down, and say whether they should be repeated next year. The accounts accompanying the report showed a balance in hand of £18 0s. 4d.

The CHAIRMAN, in calling for remarks upon the report, said it was a pity that only one paper was sent in in competition for the medals offered. It was now for the meeting to decide whether or not they would give a medal to the one competitor who had sent in a paper. The Committee had come to the conclusion that it would be wise to do so; but, of course, it remained with the members to say whether they would endorse this decision.

Mr. T. HANDS (Enniskillen) believed that the paper which had been sent in had entailed a great amount of time and trouble in its preparation; and as it was the first time they had had a competition, he did not think they should discourage the writer.

Mr. D. WILLIAMSON (Clones) supported the proposal to give the medal; and he was glad that there was a member who was able to claim it. He gave the Committee great credit for the sympathetic act they had done towards the family of their late and highly respected member, Mr. Salmon.

The HON. SECRETARY thought that it would perhaps cover all the points likely to be raised if some member would propose the adoption of the report as it stood. The motion could be seconded; and then, if there was any amendment to be made—with reference to the medal, or anything else—it could come on in that way.

Mr. A. MACKENZIE (Edinburgh) proposed the adoption of the report.

Mr. WILLIAMSON seconded the motion; and it was adopted unanimously.

The HON. SECRETARY said that, before they passed from the report, it might be as well for the meeting to say whether they approved of the conditions which the Committee had drawn up with reference to the medals, and whether they should continue them.

Mr. R. ROSS (Dungannon) considered they ought at all events to go on another year with them; and perhaps they might be more successful than they had so far been.

Mr. HANDS thought that nothing more need be said on the matter, as the report had been agreed to, and it contained the conditions of the competition; but he had no objection, if it was considered desirable, to move that a medal be offered for competition next year, on the same terms.

Mr. T. FRIZELLE (Holywood) seconded, and the motion was adopted.

NEW MEMBERS.

The following gentlemen were admitted to the Association:—

Ordinary Members: Hunter Anderson, of Tramore; Henry Boulger, of Maryborough; J. Conroy, of Galway; James Coyle, of Cootehill; Fred Eustace, of Tullamore; H. Fitzsimmons, of Magherafelt; Jeremiah Grant, of Fermoy; J. N. Harris, of Roscrea; Henry Kirkham, of New Ross; S. B. Langlands, of Coleraine; George Lennox, of Dungarven; Owen Owens, of Skibbereen; Thomas Reilly, of Strabane; and W. S. Sherwood, of Naas.

Extraordinary Members: J. Hossack, of Glasgow; C. S. Spear, of Dublin; and S. W. Stephens, of Belfast.

The CHAIRMAN said he thought the Association was getting on very well indeed, when they added to the roll in one day so many as fourteen ordinary and three extraordinary members.

ELECTION OF OFFICE-BEARERS.

The HON. SECRETARY said that the Committee had considered the matter of the election of office-bearers, and they had

a list to propose. The meeting, however, were not obliged to adopt the names on the list; it was merely put forward to assist in getting through the business of the day. They recommended as President, Mr. J. Nisbet, of Portadown; and the recommendation was unanimously agreed to. For Vice-President, the Hon. Secretary said, the Committee thought they would go further south. The Vice-President fell into the presidential chair the succeeding year; and they had pleasure in recommending that Mr. J. Auchterlonie, of Mullingar, be elected Vice-President. This was agreed to. The Hon. Secretary was re-elected; and so was Mr. E. Stears, of Lisburn, as Auditor. The following were appointed to the Committee: Mr. Patrick Egan, of Tralee; Mr. T. T. Llewellyn, of Newbridge; and Mr. R. Harrison, of Wicklow. Mr. T. Frizelle, of Holywood, was subsequently added in place of the late Mr. Salmon.

Next Place of Meeting.

The Hon. Secretary said that Mr. Nisbet having been appointed President for next year, he had expressed his wish that the Association should meet at Portadown. The Committee thought this was not an unreasonable wish; and they would like to meet it. Perhaps the following year if Mr. Auchterlonie accepted office (he was absent that day, and they could not say), they might go down to Mullingar for their 1899 meeting. Portadown was a very central place, although it was somewhat north. The Committee proposed Portadown.

The Chairman said that, if they were spared to next year, he would be very pleased that they should hold their meeting in Portadown; but he did not stand out, if the members desired any other place.

Mr. Frizelle said he had an idea that they should go south with the meeting; but, seeing that they had Mullingar ahead of them, he had been relieved, to a certain extent. But he thought they should try to divide their meetings—going one year to the south, and the next year towards the north.

Mr. Llewellyn, speaking as one of the southern members, thought that the hearty welcome which they got in the north was sufficient guarantee that they would not say anything against what had been proposed by the Committee; but, personally speaking, he should be very pleased to see the meeting of the Association nearer the south. If, at some future time, it could be arranged, he had no doubt the members of the Association down south would be very glad to see the meeting held there.

It was agreed to meet in Portadown next year.

Chairman's Address.

The Chairman then delivered the following address:—

Gentlemen,—It is a matter of regret to me, and I am sure it is the same to all members of the Association, that our friend Mr. Martin, of Drogheda, whom we unanimously elected as our President for this year, cannot be with us to take the chair to-day. As Vice-President, I occupy his position; and I do so relying on that indulgence and support which since the formation of our Association you have always extended to those who have been privileged to preside over your deliberations. In the circumstances, I will not attempt an Inaugural Address worthy of the name, but will simply confine myself to a few remarks on the topics most likely to be interesting to you as managers of small gas-works. And, first, I think we have great cause to congratulate ourselves on the success that has attended our Association. It will be ten years on the 9th of next month since twenty members met in Armagh and formed themselves into the North of Ireland Association of Gas Managers; and now we have ordinary members, 42; extraordinary members, 20; and honorary members, 2—making a total of 64, as per our last report. Some of the first members have removed to other parts of the kingdom, and most likely have joined similar Associations; and some we have lost by death. Among that number is one whom we always delighted to see among us, and whose geniality of disposition and kindly word and smile we shall miss at our meeting to-day—I refer to our Past-President, Mr. P. J. Salmon, of Galway.

I think you will all agree with me that during the ten years of our Association we have one and all benefited by being members of it. Our meetings have brought us together at least once a year; and the papers read, and discussions upon them, have been useful to us in many ways. I would therefore urge upon you all the benefit it would be to yourselves to take a more active part in the business of the Association than you have done in the past; for, by imparting to others the knowledge you have gained in overcoming difficulties which will crop up from time to time, you will freshen your own memory, and you will have the pleasure of feeling that you have been able to assist a fellow-manager. I therefore trust that one and all will do what they can to make the next ten years even better than the first.

The gas industry, notwithstanding the opposition of electric light and of oil, is still growing steadily; and there is scarcely a city or town in the United Kingdom where the demand for gas is not increasing every year. One reason is that within the last few years many improvements have taken place both in the manufacture and in the mode of burning gas. Two things I may mention. In the manufacture, there are the generator and regenerative systems of retort settings; and in the burning of gas there is the incandescent system. These and other improvements have enabled gas companies to supply gas of a better quality and at a cheaper rate than they could do some few years ago. But we must not be content with what has already been achieved. We must keep working away, because no doubt there will be great improvements in the electric light, which will make it a keener competitor with gas. But the demand for more light is now so great that there is plenty of room for both the electric light and gas. I consider that, as managers of small gas-works, we have in oil a greater competitor than we have in electricity. I have inquired of a great number of people who burn oil; and I find that, taking its cost and the upkeep of the lamps only, and not counting the time spent in cleaning and trimming the lamps, they would light their houses and shops cheaper with gas at 3s. 9d. per 1000 cubic feet, which is our present price in Portadown. But very few landlords will put pipes and fittings into especially small houses; and the tenants will not do it.

Great improvements have taken place in the retort-house. The old system of direct firing is gradually disappearing; and now—not to mention inclined retorts, or patent machinery for breaking and elevating coal and drawing and charging retorts, which are in use in most of the large English and Scotch works, but which are not suitable for the small works of which we have charge—there is the generator and regenerative settings of retorts, which are coming into general use in even some of our smallest works. I cannot speak of them from personal experience, as I have not got them yet. But at present I am enlarging my retort-house, and intend putting in three ovens of six retorts each. I have not, as yet, decided which of the systems I will adopt. There are a number of patented systems, and each patentee naturally claims his as the best. I am hoping that some of you will to-day be able to give your experience of the settings you may have adopted. We all know that it is in the retort-house that our profits are made. But after the coal is carbonized, the gas made may be—and, indeed, sometimes is—partly lost by defective apparatus, foremost among which, I may say, are leaky gasholders. Indeed, I know a gas-works where the holders, two in number, have been allowed to get into such a leaky state that I believe from 8 to 10 per cent. of the gas made last winter has been lost. That gas company have, however, seen the mistake of working with leaky holders; and they are now busy erecting a holder on new ground leased for the purpose.

There has been a good deal of correspondence in the gas journals lately about gasholders, more particularly columnless holders. There are two kinds—those on the wire-rope system, and those on the Gadd and Mason principle. Of the rope-guided system I have had no experience; but I have one single-lift holder on the Gadd and Mason principle, with cup for telescoping when required, 60 feet in diameter by 20 feet deep. It was erected in 1893; so that I have now had four years' experience of it. With one exception, I have had no trouble with it. It rises and falls very steadily, even in the heaviest gales of wind. The trouble I refer to was caused by the extra severe frost of the winter of 1894. As you are all aware, the Gadd and Mason holders are spirally guided. The ice had formed very thickly on top of the water in the tank, and was frozen hard round the tops of the inlet and outlet pipes. When the holder was going down with the spiral motion, it pulled the pipes with it; the joints at the duck's-foot bends gave way; and the pipes filled with water. When the summer came round, I had to empty the tank and get all set up again. In doing so, I braced the two pipes well together with half laps, so that they will now stand a greater strain than they did at first. It caused worry and expense; but, with this exception, the holder has given no trouble, and that winter was exceptionally severe.

In regard to purifiers, I will only say: Have them large enough. With the exception of choked ascension-pipes, I know of nothing that gives rise to more trouble and annoyance than small purifiers that will not pass the quantity of gas one is making in the winter time. I have had the experience, in the dead of winter, of seeing my gasholders going down, with plenty of retorts, but with small purifiers and connections that would not pass the gas I could make; and it is not a pleasant experience to have the water blown out of the lutes, and the gas sent into the air in place of going into the holders. Last summer I had a new set of purifiers of four boxes, 12 feet square and 5 feet deep, with Weck's patent centre-valve and 12-inch connections; and last winter I purified more gas than ever I had done before, with the greatest ease and comfort, and with about 30 per cent. less lime than I used the preceding winter. I therefore say: If you want to work pleasantly and economically, get large purifiers and connections.

Prepayment meters have not succeeded so well in Portadown as I would wish them to do. I have a number working, and they are giving the consumers satisfaction. But, as I said before, landlords will not put pipes and fittings into the class of houses for which these meters are most suited. However, I have found them very useful in a number of cases where we have had trouble in collecting the quarterly accounts. By simply taking away the ordinary meter, and replacing it with a prepayment one, this trouble is disposed of. There is a difference of opinion in regard to the relative merits of gas-meters. Some managers prefer dry, others wet meters. I have had a good deal of experience with both kinds, and I prefer the wet meter. I, for my part, have never put in a dry meter unless I really could not help it; and when I do, it is almost always as a cure for jumping lights, which in nearly every case are caused by

defective gas-fitting. This opens up the often-discussed point that gas companies should have control of the gas-fittings up to the burners. If we had this, I believe there would be fewer complaints about jumping lights and bad gas. But if we had it, we should be brought in for a great amount of damages; because, whatever accidents might occur by carelessness or otherwise on the consumer's part, they would seek compensation from the gas company.

To-day we have a paper on "An Acetylene Gas Plant" from Mr. Outon, which I am certain will be interesting to us all. Then we shall have our friend Professor Macadam, from whom we have received so many valuable lectures. He will enlighten us on the subject of "Carburetted Water Gas." This will, I believe, be particularly interesting to us. Carburetted water gas has been a great success in Belfast, where they will soon have plant capable of making 6,200,000 cubic feet per day. On looking over the names of places where Messrs. Humphreys and Glasgow have put up water-gas plant, I find the smallest plant erected is for a make of 125,000 cubic feet per day. I have often thought a small description of plant, capable of making (say) from 10,000 to 20,000 cubic feet of gas per day, would be very useful to us, especially those who have charge of works in manufacturing towns, where, in the case of a sudden fog coming on, the mills and factories light up at once, when sometimes we are hardly prepared for it. In such a case, if we had water-gas plant, we could have it in working order and making gas in a few hours.

The Chairman was thanked for his address.

PROFESSOR MACADAM ON "CARBURETTED WATER GAS."

Professor W. IVISON MACADAM, of Edinburgh, delivered an address, illustrated by limelight views, on "Carburetted Water Gas." He said the subject that he had to deal with was one to which they had doubtless paid considerable attention of late, in so far as the manufacture of carburetted water gas had been introduced into many of the larger gas-works in the country. He, therefore, thought it was a profitable subject for them to consider, so that they might be able to form at least somewhat of an accurate notion as to the process generally. He could not expect to be able to explain it fully in the time at disposal; but if there were any points they wished information upon afterwards, he should be very pleased to answer any questions put. In the first place, the apparatus in use in England worked on a definite and extremely simple principle. After describing the chemical principles which underlie the process of manufacturing carburetted water gas, he said that the process was revolutionizing gas manufacture. He had been able to get several illustrations of the plant used in the two arrangements principally followed—the Merrifield-Westcott-Pearson, and the Humphreys and Glasgow. For his part, he had been unable to discover any distinct difference between the two appliances which would enable him to say that they were built upon distinct principles. He showed by means of the lantern screen that in the Merrifield-Westcott-Pearson plant the fixer was built upon the top of the carburettor, whereas in the Humphreys and Glasgow plant the fixer was a separate vessel, on the same level as the carburettor and generator. He had with him, from various sources, the results of a series of experiments in reference to the composition of carburetted water gas. These he showed on the screen; the slides containing tables illustrating the chemical composition of the gas, as well as of ordinary coal gas. One of the constituents—carbonic oxide—there was no doubt was, he was careful to point out, one of the most poisonous of gases—in fact it occupied among gases almost the same position as strychnine did among ordinary poisons. On the question as to whether it was so poisonous as to make it unadvisable to supply carburetted water gas containing a large proportion of carbonic oxide, he asked those present whether there was no carbonic oxide in ordinary coal gas. The percentage in ordinary coal gas was considerable. Therefore, if the consumers had supplied to them already a gas which was highly poisonous, what possible disadvantage could there be in putting in an extra proportion of the "poison"? He could not see any; and more than that, when they considered the dilution of the water gas through admixture with ordinary coal gas, he could see no cause for alarm. Therefore he would draw the inference that they could certainly use carburetted water gas perfectly readily. No doubt, they must not blink the fact of the poisonous quality of the gas. It was admitted to be an extremely poisonous gas; but the fact of a little addition of carbonic oxide to the supply could do no damage whatever, so far as its poisonous qualities were concerned. Both gases were highly poisonous; and if people would consume the one without complaint, he could not see why they should complain of a little more of the one sort, or how gas managers could be held responsible for any effects which might follow its use. There were many other points that he would much like to cover. There was, for instance, that of "layering," which was one of the numerous fallacies which had cropped up in connection with the two gases. The fact was that gases were similar to many liquids—that was to say that under certain conditions they did layer. But those people forgot the fact that when once the gases were mixed, they never could really separate them again. It was well known to be an impossibility. Certainly, if they put gases into a holder at different times, they might have a heavier or a lighter layer for a certain period; but if they put them in together, and mixed them thoroughly, no one had ever been able to separate them again. Therefore, if they mixed the coal gas and the carburretted water gas, as he thought was the best way, before they went to the purifiers, there could be no difficulty whatever with carburetted water gas in the matter of layering.

The CHAIRMAN said that Professor Macadam had been kind enough to consent that if any of the members wished to ask questions with reference to the remarks he had made in the course of his lecture, he would be only too pleased to enlighten them on the subject.

Mr. HANDS said he was sure they were indebted to Professor Macadam for the able lecture he had given them. Several things had passed through his (Mr. Hands') mind while the lecture was going on. One was in reference to the state of matters in Liverpool and Birkenhead. Most of them had read of the various controversies which had taken place there on the subject of water gas. It appeared that at first analyses of the gas which was being sent into the town were obtained from independent testers, who came to the conclusion that there was not the heat-giving power in it which there was in ordinary coal gas. For instance, they found that it took twenty minutes to boil a pan by water gas, which could be boiled in ten minutes by ordinary gas. He was not sure of the figures, but he believed that in Liverpool they sent out about 85 per cent. of water gas, mixed with the coal gas; and hence the great controversy that had taken place. He would like to ask what Professor Macadam thought would be a safe proportion of carburetted water gas to send out mixed with coal gas—the proportion that would give what might be called an equal heat, and which would, in a sense, do away with any controversy that was likely to take place between consumers and gas companies. He had looked at the figures given by Professor Lewes; but he thought the point was one which would be of interest to them all to have cleared up.

The HON. SECRETARY expressed his delight and gratification at the lecture to which they had just listened. He expected a good lecture from Professor Macadam—they knew what he could do in this way—but really, he thought, Professor Macadam had surpassed himself that day. He was pretty sure that none of them expected to get such an insight into the whole theory and practice of the manufacture of carburetted water gas, as they had had. The lecture was a thoroughly educational one. He was sure that, when they got it in print, they would read it with the greatest of pleasure. In the course of the lecture, he (Mr. Whimster) was thinking about the adaptability of the process for small gas-works. They knew how popular it was at the present day, and how well it had answered in large works; but the question was, Would it be so applicable for small works of the size which most of them there represented? As the Chairman said in his address, they had not seen many records of small water-gas plants. He (Mr. Whimster) thought that, perhaps, it would scarcely suit them. They saw that in Birkenhead they put the price of their coke as 6s. per ton, and the cost of gas at 15d. per 1000 cubic feet. In Belfast the price of coke was put down at 12s. per ton, and the cost of gas into the holder at 1s. 6d. per 1000 cubic feet. In most of their cases they could scarcely get their coke customers satisfied; and they could often get £1 per ton for coke. He did not see, with these prices, how they could afford to make carburetted water gas. His cost for gas of 20 to 21 candle power, into the holder, was about 1s. 3d. per 1000 cubic feet; and it therefore appeared to him that carburetted water gas would not be suitable for him. Professor Macadam alluded to the speed with which the gas could be made. It was plain that this would be very handy; and that was just the point. They knew that when they got into the dead of winter, and were working from hand to mouth, as it were, sometimes a sudden darkness came on, everybody lighted up, the holders were running down, and they would be very glad indeed if, in three hours, they could start a plant working. But it struck him the arrangement would not work out in that way. By and bye they would be making so much carburetted water gas and so much ordinary gas—both plants would be working pretty regularly; and they would just be as badly off as before if a sudden darkness were to come on. They would not have a reserve plant, because the water-gas plant would not be kept as the stand-by which they were told it would be. And, perhaps, if they had such a plant in small works, they would be taking their full use of it, and not having it as a reserve plant at all. These were just remarks by the way; and he begged, in conclusion, to move a hearty vote of thanks to Professor Macadam for his lecture.

Professor MACADAM said that the complaint first raised, as to the value of water gas for heating purposes, was one of which he would say that they all knew the statement that it was of 5 per cent. less heating value than ordinary coal gas. He had however, calculated the figures from the two analyses he showed; and he found that, making due allowance for the removing of latent heat by steam, with equal proportions, the heating value of carburetted water gas was about 3 per cent. less—not more than that. He knew that a great many complaints had been made, with regard to heating power; but he was afraid that

they were like many other complaints they had in regard to gas-works—they were not well founded. No one could possibly tell the difference as between 3 per cent. and 5 per cent. As to Mr. Whimster's remark about small works not having a water-gas plant, he doubted whether he could really present the process as adapted for small works. There were so many things to be considered, one of which was the getting of coke for the working of the process. To produce the coke, they must continue to make coal gas; so that taking everything into consideration he did not think it would be an advantage in small gas-works, because as a rule, they obtained a better price for their coke. He might say that when Mr. Stelfox took his price of 12s. per ton for coke, it was the price he was getting for coke when he started the process. He was now able to get rid of every ton of coke—last year at 18s. per ton; and he told him that the value of the coke this year, in consequence of the diminished output, would not be far short (if it were at all) of the total amount received for coke last year. The actual result with him had been that, not having an over-stock of coke, he had not required to bring down the price of it; and therefore he had been able to get 18s. or 19s. per ton for it all through. Mr. Whimster seemed not to be aware of one thing, which was that in a big works all these water-gas plants had been put in in duplicate. For instance, in Belfast the previous day, of four generators three were not working—only one was. The other three were ready to go on, at any moment. He put the question to Mr. Stelfox how long it would take to heat up; and he said it could be done in five hours.

The Hon. Secretary: If they make up their mind to give a certain proportion of carburetted water gas and of coal gas, and if they put on another set of generators, where is the stipulated proportion?

Professor Macadam: If they stipulate, that is quite a different matter.

The Hon. Secretary: They have stipulated in Liverpool, I believe.

Mr. Hands: The Board of Trade are now asking for the quantity to be stated in the returns.

Professor Macadam: They would just have to put on more coal-gas retorts; but, after all, when it comes to a pinch, one cannot stick to a stipulation.

The Papers Read.

On reaching the competition paper, the envelope bearing the *nom de plume* of "Hydraulics" was produced, and, having been opened, was found to contain the name of Patrick Egan, of Tralee. Mr. Egan was present, and read his paper, entitled "A Difference in Hydraulic Mains." This paper, along with "A Description of an Acetylene Gas Plant," by Mr. C. B. Outon, of Inchicore (read by the Hon. Secretary in the author's absence), and the discussions which followed the papers, will be given in a subsequent number of the "Journal."

The Hon. Secretary proposed that the heartiest thanks of the meeting should be given to Mr. Nisbet for his conduct in the chair.

Professor Macadam said he would like to propose another vote of thanks, as well as second the one before them. He wished to propose a vote of thanks to the Hon. Secretary. They did not know the amount of hard work he had to do in connection with the Association, during the year. He trusted that all the members would do what they could to assist him, by sending in papers to be read, or otherwise, at subsequent meetings.

The Hon. Secretary and the Chairman returned thanks for the recognition of their services.

The meeting closed at five o'clock.

Excursion to Lough Erne.

On Wednesday the members and their friends, to the number of about forty, enjoyed an excursion to Lough Erne. They journeyed by rail from Omagh to Enniskillen, where they embarked on board the pleasure steamer "Lady of the Lake," and sailed in her down the Lough for about ten miles, amid the many isles which, like gems, adorn the waters of this singularly charming lake. Under the shelter of one of the islands the excursionists transferred themselves to steam launches, in which they were conveyed to Paris Island. This island is in the occupation of Mr. Hands, of Enniskillen, who has had it prepared for the reception of large parties of visitors. On this occasion, after an inspection of the island, on which there are many specimens of the ingenuity of Mr. Hands, they sat down to a substantial dinner, for which, by this time, all had a relish. After dinner, two parties were formed, one of which proceeded by launch to view the grounds of the Marquis of Ely, on the mainland, and the other repaired to Devenish Island, on which there are a number of interesting ecclesiastical ruins, and a round tower, said to be in the best state of preservation of any of the round towers which are so common in Ireland. Both sections of the company met in the afternoon at the railway station, where farewells were interchanged, and all repaired homeward. Before parting, Mr. Hands was cordially congratulated on the success that had attended the excursion, as he really deserved to be; the whole of the arrangements for the day's outing on Lough Erne having been in his hands.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The fifth of the papers read at the annual meeting of the above Association was of more than ordinary interest, as it dealt with an appliance of which there has been little experience in this country, but which, it is expected, will soon win for itself a place in the estimation of water engineers. It was read by Mr. W. G. Kent (London), and was entitled—

The "Venturi" Meter in Relation to the Measurement of Water in Large Mains.

Having explained and commented upon the conditions appertaining to the method of measurement of water in bulk, the author gave the following description of the instrument: The "Venturi" meter consists of two parts—the tube and the recorder. The tube forms a part of the ordinary pipe-line; and only differs from it in that it presents for a short distance a truncated reducing cone, coupled by a throat-piece to a similar expanding cone. There is, therefore, no moving part whatever in contact with the flowing water; and any interruption of the supply from such a cause is impossible. By the operation of one of Nature's laws, the reducing cones which form the "Venturi" tube produce practically no loss of head. At the usual maximum velocities through any size of tube, the friction head will range between 1 foot and 2 feet.

The only part of the instrument which is subject to the ordinary action of wear and tear or of accident is the recorder; and as this is placed either in the engineer's office, or in any other convenient spot where its whole working is always to be seen, and as it can be shut off from the tube at will, it is evident that no interruption of the supply is caused by any cleaning or repairing of the instrument. There are small pipes connecting the recorder with the "Venturi" tube; but should these become choked or corroded in the course of years, it is possible to replace or clean them without interfering with the tube itself The recording instrument, although generally fitted with a diagram arrangement showing the rate of flow, as well as with a counter which gives the total quantity passed, can, however, be fitted with either of these alone. The recording instrument. may be fixed anywhere within 1000 feet of the tube; or the registration can be conveyed electrically to any distance.

The "Venturi" meter takes its name from an Italian philosopher, who in 1791 made experiments with water flowing through diverging and converging pipes, but who failed to put to any practical use the curious law of hydraulics which he observed. This law is, that water flowing through a pipe of diminishing area loses the pressure which it exerts laterally as it gains in velocity; so that at the "throat" of the "Venturi" tube, which unites the two truncated cones, it is only a question (within a certain limit of static pressure) of obtaining a sufficiently high speed in order to entirely lose all pressure, and exert instead a vacuum or sucking action. Conversely, water flowing through an expanding cone loses speed and gains head. Consequently the "Venturi" tube produces a great depression in the hydraulic gradient at the throat of the instrument, but restores it practically to its original level at the outlet.

To describe the action graphically: With the water at rest, the gradient passing through the three points—inlet, throat, and outlet—would form a straight line; but as the flow began and increased in velocity, the line would take the shape of a V of correspondingly increasing depth—the height of the outlet leg being slightly less than that of the inlet leg. The difference of level between the inlet and the throat is termed "Venturi head," and that between the inlet and outlet "friction head."

The relation of the area of the throat to that of the main in which the tube is inserted is entirely governed by the requirements of the water engineer as to maximum and minimum registration; the proportionate area of the throat being increased when the maximum and minimum of desired registration are high, and being decreased when they are low. As an instance of this, two "Venturi" tubes recently constructed may be mentioned. In one, the ratio of the area of the throat to that of the tube is as 1 is to 4·5; while in the other it is as 1 is to 20. This adaptability of the instrument to the requirements of the case is a peculiar but valuable feature.

To Mr. Clemens Herschel, an eminent hydraulic engineer of America, who, at infinite pains, demonstrated beyond question the reliability of the important hydraulic law above referred to, and to the Builders' Iron Foundry, of Providence, who, with him, have worked out the details of the counter recording instrument, is due, says the author, the credit of having placed before the water engineers of the world an instrument that renders possible the measurement of water in mains of any diameter under conditions that present no difficulties or dangers. The apparatus, as employed in England, differs somewhat from that used in America. But the same factors of time and pressure have, of course, to be multiplied together, and the difficulty in doing this mechanically is overcome by a similar device, whether in the American or English recorder.

It is evident that with a difference of pressure between the throat and the up-stream ("Venturi head") having a constant relation to the discharge from the tube, it is only necessary to multiply the square root of this pressure by the ascertained coefficient and by time, in order to obtain the total quantity passed. The register consists, broadly speaking, of two parts:

First, of a mercurial "U-tube," which, being connected with the up-stream and throat, brings in the element of Venturi head; and, secondly, of the clockwork and gear controlled thereby, which supplies the element of time. The connection between the pressure and time is established by means of floats, resting on the mercury in the U-tube. In the combined instrument, we have a diagram giving the rate of flow, as well as a counter showing the total quantity passed, and both legs of the U-tube are utilized as a matter of preference. The floats are made of iron and vulcanite, so adjusted that the vulcanite collars just sit on the surface of the mercury; being in this way more than in any other susceptible to a rise or fall. These floats carry light racks, gearing into pinions, which convey the motion to the small pulleys placed outside the tubes. The pulleys are fitted with wires, which pass up to the clockwork mechanism. One on the left belongs to the diagram recorder, and supports from its upper end a pen-carriage; and one on the right, which regulates the amount of registration by the counter, is fitted with a small carriage, whose function it is to engage and disengage the spur wheel on the bottom of the integrating drum and the pinion which drives the counter. The height of the pen-carriage is directly proportionate to the height of mercury in the left leg of the U-tube—in other words, to the Venturi head—so that the registration is direct and simple.

The counter mechanism is a little more complicated. In order to comply with the hydraulic law which makes the quantity discharged through a pipe vary directly as the square root of the head, it is necessary to square root the Venturi head (which is given by the right leg of the mercurial tube) before multiplying it by time to obtain the total quantity passed. It is done in this way: The integrating drum is constantly revolving so many times in an hour—as a matter of convenience, six times. Its surface is on two planes—one of the full diameter of the drum; the other, of a reduced diameter, forming a recessed surface. The line which separates one portion from another is a square root curve. On a diagram, the drum is represented as having been rolled out; the part coloured black being the recessed portion of the drum, and the other the raised. When the small carriage, the height of which is controlled by the Venturi head, is in contact with the black or recessed portion, communication is established by means of the spur wheel and pinion with the counter, and registration takes place. When the carriage is in contact with the raised portion of the integrating drum, the pinion is held out of gear with the spur wheel, and consequently no registration occurs. If no water is passing the tube, the carriage would be at the top of the integrating drum, on the edge of, but not on, the recess. Therefore no registration would take place. If, on the other hand, water were passing at full speed, the Venturi head would be at its maximum, the carriage would be at the bottom of the integrating drum, and in contact with the recessed portion, and consequently registering the whole time. Registration at any intermediate spot must be in proportion to the square root of the head; and it will be seen that this is so. If, for instance, we imagine the height of the drum divided vertically into 4, it follows that the registration at 4 should be twice the registration at 1; the square root of 4 being 2, and of 1, 1. Now if we taken the horizonal travel at 1, it will be found to be exactly half that at 4; and so at this and any point of registration is proportionate to the square root of the head.

A great advantage of the combined instrument is that any incorrectness would be at once apparent, as one side checks the other. It is only necessary to compute the diagram, and compare it with the counter, to see that both are correct. The instrument is also checked by turning a cock, which places the two legs of the U-tube in equilibrium, when both the counter carriage and the diagram pen should return to zero. Means are provided for any necessary readjustment.

The "Venturi" installations in England, have, until recently, been chiefly experimental, with a view to ascertain the type of counter best suited to the requirements and practice of the English water-works engineer; but eleven meters, of sizes varying from 12 to 48 inch mains, are now either at work or in course of construction. In America, where the instrument was first introduced, there are now upwards of 70 in operation, the largest of which is fitted to a 60-inch main. The 48-inch tube in England above referred to is fitted at the East London Water-Works, at the head of the canal leading from the group of reservoirs to the filter-beds at Lea Bridge. It is capable of passing 37 million gallons per day of 24 hours with a loss of head of 1 foot, or 60 million gallons per day of 24 hours with a loss of head of 2·5 feet. This is, the author believes, the largest meter in England.

Mr. A. Towler (Leeds) expressed a little diffidence as to the accuracy of the tests of the meter in dealing with such large volumes of water as would flow through pipes of (say) 60 inches diameter. It seemed to him to be such a difficult thing to test; and he would like to learn how the tests were actually made.

Mr. F. J. Bancroft (Hull) also desired to know how the accuracy of the meter was tested; and whether, if one of the meters was placed on a pumping-main, the pulsations affected the registration. If they had here an instrument that would give them the delivery of water within 1 per cent., it would be very valuable, as they had all experienced the difficulty of working out pump discharges, and taking the stated figure for slip or short stroke, as the case might be. In pumping-engines, they knew how the circumstances varied day by day according to the efficiency with which they were maintained.

Mr. D. M. F. Gaskin (Nottingham) asked whether Mr. Kent could give the members some idea of the experiments that were carried out on the Liverpool water-mains. If he was not mistaken, the meter was tried on a 16-inch main, and was checked by two ordinary meters. If they could be assured that this apparatus would be perfectly accurate when placed in circumstances where the ordinary meter was likely to get out of order, it would greatly assist water engineers in their duties.

Mr. Percy Griffith (London) inquired whether varying flows of water affected the accurate registration of the meter—especially the minimum amount of flow proportionately with the maximum.

The President (Mr. H. Ashton Hill) remarked that hitherto water engineers had managed without this meter; but, after the explanation and information they had had in regard to it, it became a question for them to consider whether they could not advantageously introduce it. He thought there was no doubt that, in course of time, as it had proved its utility in America, openings would be found for it in this country. With reference to the Liverpool tests to which Mr. Gaskin alluded, it would be interesting to know whether or not the three meters agreed in their registration.

Mr. Kent said the questions asked mostly turned upon the accuracy of the meter. Mr. Towler had rightly referred to the difficulty of testing water flowing through large mains. A test had been made with an 84 inch pipe by Mr. Clemens Herschel, who ranked very highly among hydraulic engineers in America. He had exceptional facilities for making tests, because at the time he was engaged at the Holyoke Water Power Company's testing-flume, where large turbines were constantly under trial; so that they had the means of testing water flowing through large mains. His tests were perfectly conclusive; there being no variation whatever within 1 per cent. in the results obtained. Beyond this, directly they got the meters to work in America, they began testing on reservoirs; and the results obtained were so satisfactory to the engineering profession there, that the meter was being adopted on a large scale. Regarding the tests at Liverpool, they were made, by the kindness of Mr. Parry, with an experimental recorder. He believed it was a 15-inch meter that was tried; and the flow was checked by two positive meters tandem to the "Venturi"—the variation between the registration of the former and that of the "Venturi" being under 1 per cent. for something like six weeks. He had not had any great personal experience with these meters; but he might say the results which had so far been secured in England tallied with those which had been obtained in America. The meter would not be affected by a pumping-main, because it worked on the principle of averaging. The cock leading from the top of the "Venturi" apparatus would in such a case be partly closed down; but, even if it caught the full effect of the pulsations, the mercury moved somewhat sluggishly, so that it did not feel the rapid pulsations. The results on pumping-mains in America had been quite as satisfactory as on gravitation mains. As to Mr. Griffith's question, the usual minimum and maximum was about 1 to 20; but they were now making some meters where the minimum would be one-fortieth of the maximum. Where the minimum was low, the throat was contracted.

Mr. E. Sandeman (Plymouth) asked whether it was possible there would be any loss supposing the flow through the tube was exceedingly slow. Would the recorder be sufficiently delicate to register it?

Mr. Kent replied that it would, if the engineer, when the apparatus was put in, said he wanted it to register down to a certain minimum.

Mr. C. E. Jones (Leyton) inquired what effect very hard or soft water would have on the meter. Would corrosion in the pipes seriously interfere with the registration?

Mr. Kent answered that, if there was much alteration in the figuration of the tube, no doubt it would. They, however, made the throat-piece so that it could be taken out in half an hour in order to clean the tubes.

Mr. T. Kennedy (Kilmarnock), referring to some remarks that had been made as to the use of reducing valves, said there was no doubt there was increased velocity through a reduced valve. But the length was so small compared with the length of the pipe that it had little effect; and there was always a great deal of head to spare in a long length of main.

Mr. Kent, replying to a further question by Mr. Towler, stated that there had never yet been any condition of maximum or minimum imposed that they could not well and properly deal with by the "Venturi" meter. It was easy to put a supposititious case in which they could have an objectionable feature; but he had never found any difficulty in actual practice. In a trunk main, 1 to 10 covered the minimum and maximum; but they had dealt with 1 to 40.

Mr. L. Holme Lewis (Manchester) contributed the next paper, which, in his absence, was read by the Secretary. It dealt with the subject of

HYDRAULIC POWER SUPPLY.

The larger part of the paper was devoted to a historical sketch and description of the Manchester Corporation Hydraulic

Power Works; but it was prefaced by a short account of the work done in developing the use of water as a motive force by Joseph Bramah in 1795, by Lord Armstrong in 1848, and, among others, by Mr. E. B. Ellington, who was the first to actually establish works for the transmission of hydraulic power for public use.

It was on Feb. 27, 1890, that the Water Committee of the Manchester Corporation passed a resolution in favour of putting down a plant to supply water under pressure for the purpose of hydraulic power; and an Act conferring the necessary powers was obtained in 1891. The Committee in charge of the scheme, having ascertained the character of the works already established and developed in other towns under the direction of Messrs. Ellington and Woodall, decided to retain the services of Mr. Corbet Woodall; and under his supervision, the whole of the works were carried out. The supply was first available for use in February, 1894; and the rate at which it has been taken up exceeded the most sanguine anticipations of the most ardent supporters of the scheme. A tabular statement shows that, in the quarter ending June, 1894, the number of machines connected was 216, and the quantity of water supplied 3,726,000 gallons; while in the past quarter, there were 865 machines connected, and 22,415,000 gallons of water supplied.

The water used on the system is taken from the Corporation low-pressure main, and is conveyed through two separate service-pipes into a storage tank, which forms the roof of the boiler-house. The tank is divided into three separate compartments, any one of which can be isolated from the others, and has a full complement of valves and connections, which admit of the work being carried on, in case of necessity, equally well with one compartment as with the three. The total storage capacity of the tanks is 230,000 gallons.

The machinery was described by the author at some length. Briefly, it consists of five steel boilers of the double-flued Lancashire type, with Galloway tubes. Each boiler is 7 ft. 6 in. diameter, and 30 feet long; and the flues are 3 feet diameter, with five tubes in each. There are six sets of vertical surface-condensing direct-acting triple-expansion steam pumping-engines, which are constructed to the design of Mr. Ellington. Each set is capable of exerting about 200 indicated horse power with a steam pressure of 120 lbs. per square inch, and of delivering, at a piston speed of 240 feet per minute, 230 gallons per minute against an accumulator pressure of 1120 lbs. per square inch. This is the normal speed of running; but they are capable of running at a piston speed of 260 feet per minute, and giving a maximum delivery into the high-pressure mains of 250 gallons per minute. The floor space occupied by each set is only 14 ft. by 10 ft. The accumulators are two in number; each having a ram 18 inches in diameter and 23-feet stroke. The weight casings, which are 11 ft. 3 in. diameter, are constructed of wrought iron, and are charged with iron slag to give the required pressure. The total weight of casing, slag, and ram of each accumulator is approximately 129 tons, to pump against which, with an 18-inch ram, is equivalent to pumping the water a height of about 2500 feet.

The water is conveyed from the pumping-station into the streets in four 6-inch cast-iron pipes, which are laid in circuit, with stop-valves at intervals of about 440 yards. The delivery from five sets of engines, all working at the same time, and at their normal speed—viz., 60 revolutions per minute—is 1140 gallons per minute; so that, with an equal flow in each of the four 6-inch pipes, the velocity would be 3 feet per second. To provide against the frictional loss due to this velocity, valve passages, and bends, the accumulators are loaded to give a pressure of 120 lbs. per square inch in excess of that guaranteed by the Corporation—viz., 1000 lbs. per square inch. The most distant points of the mains from the station at present are about 1½ miles; and about 13½ miles of pipes—varying from 6 to 2 inches diameter—have been laid.

The author next explained the means taken for the detection of leakage; the absolute integrity of the mains and valves being one of the most important factors in the successful working of a hydraulic power undertaking. Then as to efficiency, the meters on the consumers' premises were formerly low-pressure; but they have been replaced by high-pressure ones, which measure the power before it has passed through the machinery. The efficiency of the system is determined by the fraction representing the ratio of the quantity registered by the meters to that delivered into the mains as ascertained from the readings of the engine counters. During the twelve months ending March last, the power registered was within 3 per cent. of that delivered into the mains. This the author believes to be the highest efficiency hitherto attained in connection with any scheme of hydraulic power supply. The present plant has sufficient capacity to supply 1000 machines; and as 870 are already "agreed for," the author has every reason for believing the present margin of generating power will be wiped out in from nine to twelve months.

The author being absent, only a few remarks were made on the paper.

Mr. W. Matthews (Southampton) said he noticed that the author spoke of a velocity of 3 feet per second in the mains, which was rather greater than they were accustomed to work at in ordinary water-works practice. He should have liked to ask Mr. Lewis whether he found, as the result of his experience, that 3 feet per second was the most economical speed, taking friction into account on the one hand, and the size and expense of the pipes on the other. He had also spoken of having taken out the low-pressure meters, and put in high-pressure ones; and he (the speaker) would be glad to know the type of the latter.

Mr. D. M. F. Gaskin (Nottingham) had not the slightest hesitation in congratulating Mr. Lewis upon having done away with the low-pressure meters. They were in vogue in some parts of the country; but those places were much behind the times. He would also be pleased to know something about the meters used with these high pressures.

Mr. W. G. Kent (London) stated that the only thing exceptional about the meter was the case. The working parts were precisely the same as were used for ordinary water-works purposes; but the case was made to withstand a pressure of 2500 lbs. per square inch.

A COMPARISON OF FUEL-GAS PROCESSES.

By F. L. Slocum.

[Extracts from a Paper read before the New York Section of the Society of Chemical Industry.*]

The practical supplying of fuel gas to the public in sufficient quantities and of satisfactory quality has been an established industry for little over a decade. Like many other industries, the beginning was made with supplies from Nature; and they are still largely obtained from this source. The successful prosecution of fuel-gas supply in the last ten years has fully and accurately demonstrated the advantages derived from using gaseous fuel in every branch of industry and domestic economy, as well as developing very completely the most economical appliances for handling and burning the same. In other words, the business of distributing, supplying, selling, and burning fuel gas is well developed, and the public are thoroughly educated to its use. This applies, of course, in its fullest sense, to the natural gas belt; but it is by no means confined to it, as the annual statements of nearly all gas companies throughout Europe and America show an annually increasing percentage of consumption of their total output for fuel and power purposes, and this at a figure which is far above a comparative price with solid fuel in almost every instance.

As gas undertakings are divided into two departments—the manufacturing and the distributing—and as the supply of natural gas is failing, we are confronted, in the natural gas region, with the serious necessity of developing the manufacturing processes so that they will be adaptable to the supplying of artificial fuel gas under all conditions. The last few years have seen processes and methods almost out of number come and go; yet through the numerous negative results, as well as the real advances, there has been withal some permanent gain. The probable lines on which fuel gas will be produced have been clearly established, and a marked beginning has been made in each field. This is indeed something, for the field is large.

The methods of producing fuel gas can be divided into three classes: (1) Coal gas production by distillation, including bye-products ovens. (2) Bituminous coal water-gas producers, or intermittent machines using bituminous coal, blasting or heating with air, and then decomposing steam. (3) Producers, or continuous gas machines, of the Mond and Siemens type. These methods are classified according to the heating value of a cubic foot of the gas which they respectively produce; and they will be taken up in the same order.

Perhaps the greatest detriment to the more rapid development of successful fuel gas processes has been the so far unattainable ideal in heating value per unit of the natural product—*i.e.*, 980 British thermal units per cubic foot. Numerous heat-unit analyses of natural gas at Pittsburgh made with the Junkers calorimeter, show the average to be 978 to 980 B.T.U.; the gas often analyzing nearly pure marsh gas (CH_4). I therefore use for all calculations with the Pennsylvania natural gas 980 B.T.U. as the proper average. This, however, does not hold good with other fields.

The highest attainable heating value in manufactured gas is from coal gas. This gives 600 to 625 B.T.U., which is approximately two-thirds of the indicated efficiency of the natural gas. This makes natural gas the ideal; and it has led, of course, to unnumbered fruitless attempts to duplicate it. The only possible way has been by means of petroleum; and petroleum will not be considered here in any way, as its value in the liquid or natural form per million heat-units is sufficient to debar further manipulation with the object of producing fuel gas to compete with coal. The fuel gas of the future will almost unquestionably be a gas very much lower in heating value per cubic foot than is now generally sought. It is not going to be with the consumer so much the question of the heating efficiency of a cubic foot of gas as the cost of his gas per available million heat-units.

Coal Gas Production.—There is little unsaid on this question. The present methods of manufacture are fully abreast of the times in the quality and quantity of gas obtained from a given coal. The tar is being disposed of to the best advantage, as is also the ammonia. A general change will be gradually effected by which the cyanogen will be saved—usually 12 to 16 oz. per ton of American coals—as well as the sulphur and benzol. This latter will average approximately 1·5 gallons per ton of coal

* Reprinted from the Society's "Journal."

carbonized. This will be accomplished more from necessity, through larger demands for gas, than from new processes. The one thing which needs a radical change is the quality of the coke. This is caused by the ever-increasing demand for a metallurgical coke with the gradual diminishing beds of ideal coking coals for beehive ovens, and also the diminishing of the anthracite deposits, the substitute for which must be crushed coke of suitable hardness.

With the above conditions in existence, it is no wonder that the bye-products oven has lately been brought into such prominence as to make it appear, erroneously, in a class by itself. This view has been strengthened by the great secrecy maintained by several of the bye-products oven promoters as regards their machinery for, and methods of, handling the gas. It seems to the writer that the bye-products oven is only to be an improvement in one department of coal gas manufacture—viz., the retort-house.

When once the gas is made and delivered into the hydraulic main, it has entered wholly into the domain of the coal-gas manufacturer. No one, I think, will successfully contradict this fact. If the bye-products coke oven can replace the retort by making a better and a more saleable coke, as good and as great a quantity of gas, with as much tar and ammonia, at a less cost for labour and repairs, then the retort must be largely superseded by the oven; and this one disadvantage in coal-gas manufacture will have been brought abreast of the requirements of the times. This is now practically an accomplished fact.

The great drawback in the use of the bye-products oven has been some means of economically heating them, as the ovens require gas firing to produce a good quality of coke. This, however, is most satisfactorily accomplished by producer gas (preferably the Mond type). Only a limited amount of recuperation is required. One of the best types for recuperation is the one employed by Carvès. The system of regeneration does not seem to produce as good coke, on account of regular fluctuations in the temperature of the oven during coking producing a more unevenly porous coke, and forming a larger percentage of higher decomposing hydrocarbons, thus making a greater percentage of volatile matter in the coke. Assuming the bye-products oven occupies the place of the retort, the products of one ton of coal, at a reasonable cost of manufacture, are: Metallurgical coke, 1400 lbs.; crude tar, 100 lbs.; ammonia, 5 lbs.; cyanogen, 0·75 lb.; and 10,000 cubic feet of gas (600 B.T.U. = 6,000,000 B.T.U.). One ton of bituminous coal averages 30,000,000 B.T.U. In assuming 600 B.T.U. per cubic foot for coal gas, I have taken a very conservative average, and one that can always be maintained in practice, as the following analysis made while carrying out a test of Dominion coal with ordinary retorts, will show:—

	Per Cent.
Moisture	1·00
Combined volatile matter	40·00
Fixed carbon	53·00
Ash	4·00
Sulphur	1·00
Nitrogen	1·00

The coke analyses were—

	No. 1. Per Cent.		No. 2. Per Cent.
Moisture	0·44	..	1·31
Combined volatile matter	2·10	..	2·89
Fixed carbon	86·52	..	87·27
Ash	8·70	..	6·62
Sulphur	2·24	..	1·91

The analyses of the gas from this coal is a good average coal gas. The heat-unit determinations were made with a Junkers calorimeter between the gas analyses. They do not represent the same gas as that analyzed, but give an average of the gas, and show the slight fluctuations during carbonization:—

—	First.	Second.	Third.	Heat Unit Tests.
	Per Cent.	Per Cent.	Per Cent.	B.T.U. per Cub. Ft.
CO_2	2·6	3·0	1·4	First 617·9
Illuminants	5·2	5·0	6·2	Second 644·9
O_2	0·8	0·4	0·6	Third 617·0
CO	5·8	5·8	4·5	
CH_4	33·7	35·1	39·2	Aver. 626·6
H_2	50·4	44·6	44·8	
N_2	1·5	6·1	3·3	

A sample of gas, taken when the same works were running on Westmoreland (Pennsylvania) coal, gave on analysis the following results:—

	Per Cent.
CO_2	1·8
Illuminants	5·9
O_2	1·1
CH_4	42·8
CO	3·6
H_2	40·9
N_2	3·9

Candle power, 17·78; heat value, 690 B.T.U. per cub. ft.

This, with the other analysis given above, shows that there is no difficulty in producing at least a 600 H.U. gas and maintaining it in daily manufacture.

Bituminous Coal Water-Gas Producers.—Under this type are classed such apparatus as manufacture gas from bituminous coals by means of first heating a large body and depth of fuel with an air-blast—burning the coal at bottom to coke—then admitting steam and producing water gas; the water gas so formed passing up through the undecomposed coal—thus distilling off a part of the volatile matter as coal gas. The best developed machines of this type are the Hastings and the Loomis. The regular water-gas machines are not considered here, as they use only expensive fuel, and produce a lower heating value gas.

An analysis of blue water gas made from gas-house coke in the Granger machine gave—

	Per Cent.
CO_2	4·80
CO	41·50
H_2	52·41
CH_4	0·02
N_2	0·47

A heat-unit determination of the same gas with the Junkers calorimeter gave 331·5 B.T.U. per cubic foot.

The ideal of this class of gas-machine would be a machine which would remove all the volatile matter from the coal as coal gas, and convert all carbon into water gas. This would be accomplished in part by either getting the necessary heat from outside sources to maintain incandescence, or when blasting up to allow the blast gases to pass only through the carbonized portion of the coal. Numerous patents have been taken out to accomplish this in the different ways mentioned; but as yet this field is open to very marked improvements.

The process which is the best developed in this class is the Hastings, or, as it is called in the European patents, the Hastings and Hauk process. The writer had occasion to examine this process, which is in operation as an auxiliary to the natural-gas plant at Louisville (Ky.). The test extended over a period of ten days. Jellico coal was used, analyzing as follows:—

	Per Cent.
Carbon	63·10
Volatile matter	32·53
Moisture	1·90
Ash	2·40
Sulphur	0·07

In this process, they work with a mass of fuel from 10 to 12 feet deep. In heating up by means of the air-blast, the gases produced rise up through the whole mass of fuel; thus destroying a part of the volatile matter of the coal. An analysis of these blast gases taken at the outlet of the machine gave—

	Per Cent.
CO_2	13·00
O_2	2·00
CO	9·00
N_2	76·00

The volume of this gas produced per blast was 12,085 cubic feet corrected to atmospheric pressure. It was found afterwards that there was an extra air-blast over the coal, which destroyed all traces of marsh gas and hydrogen. The blast gas was then completely burned in an upright tubular boiler recuperating nearly 10 per cent. of the heat generated in the process of manufacture. It is, however, safe to assume that quite as much of the volatile matter is distilled with the blast gases as by the water gas, as the heat-range is necessarily exactly the same in each. The coal gas in the coal should be in volume approximately one-fifth; hence the following calculated mixture should represent the resultant gas in this process. The actual analyses made from two different runs show that this deduction is practically accurate:—

—	Water Gas. (Typical.)	Coal Gas. (Typical.)	Mixture. (Calculated.)	Analysis No. 1. (Found.)	Analysis No. 2. (Found.)
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
CO_2	2·2	2·0	2·16	8·2	5·4
N_2	3·4	2·0	3·12	5·2	9·2
O_2	0·4	1·0	0·52	0·6	1·1
H_2	57·5	49·0	55·80	43·8	41·9
CH_4	..	35·0	7·00	8·2	7·5
CO	36·5	6·0	30·40	32·8	34·0
Illuminants	..	5·0	1·00	1·2	0·9

B.T.U. No. 1, 363·3; No. 2, 342. Sp. gr. of gas, ·576.

The large percentage of non-combustibles is caused by the poor construction of machine used, there being leaky valves which allowed air to work in during gas making, as a constant air pressure was maintained against these valves. The average yield of the 363 B.T.U. gas per ton of 2000 lbs. of coal was 51,250 cubic feet (corrected). There was considerable tar produced, and 8·03 lbs. of ammonia per ton of coal, calculated as sulphate. The gas indicated approximately 5-candle power.

Taking the first analysis in the above table, which gave 363·3 B.T.U. per cubic foot, and multiplying by 51,250, the number of cubic feet of gas from a ton of coal, gives an efficiency of 9309 B.T.U. in gas from each pound of coal used. This weight of Jellico coal gives 15·105 B.T.U. (calculated). This, therefore, shows a fuel efficiency of 61·63 per cent. of the coal used, without considering the coal used to produce steam.

I have received from the Company who operate the plant the following as the average of their winter's operation. (They make about 2,500,000 cubic feet per day.) Each 1000 cubic feet required for production: Coal, 23 lbs.; coke, 5 lbs.; coal under boiler, 10 lbs.—total 38 lbs. The time of admitting the

steam, or of gas making, was eight minutes. On one of these normal runs, the gas was sampled every two minutes, and analyzed, with the following results:—

—	End of First Two Minutes.	End of Fourth Minute.	End of Sixth Minute.	End of Eighth Minute.
	Per Cent.		Per Cent.	Per Cent.
CO_2	4·4	Lost	9·00	9·5
Illuminants	1·0	,,	0·80	0·7
O_2	1·0	,,	2·20	3·8
CO	33·0	,,	28·80	23·5
H_2	44·2	,,	45·24	45·1
CH_4	7·8	,,	4·20	6·2
N_2	8·6	,,	9·76	11·2

The analyses show that the hotter the gas the greater the amount of volatile matter carried off. This type of apparatus, with some few changes in construction, should produce a 400 B.T.U. gas. This has been corroborated in part by some recent analyses made on a new plant, in which some of the errors noted in the first had been corrected. The coal used was ordinary slack, mined near Greensburg (Pa.); and it analyzed as follows:—

	Per Cent.
Moisture	1·00
Volatile matter	31·93
Fixed carbon	59·99
Ash	7·08

No oil was used. The sample of gas for the first analysis was taken from the large holder; the second, from a second holderful and a different run. The results were as follows:—

	First. Per Cent.	Second. Per Cent.
CO_2	7·90	8·10
Illuminants	1·40	1·10
O_2	0·10	0·30
CO	28·50	28·10
H_2	48·65	49·65
CH_4	8·20	9·82
N_2	5·25	3·95

The calorimeter test gave 390 B.T.U. per cubic foot, which shows that by a more careful exclusion of nitrogen and a proper reduction of the carbon dioxide there will be no difficulty in making and maintaining a 400 B.T.U. gas.

With proper appliances for utilizing the producer gas formed in blasting up and the saving of the waste heat in the gas made, the net actual efficiency should be raised to at least 70 per cent. of the fuel charged, while any class of fuel can be used. The net results per ton of coal at a very moderate cost of manufacture would be approximately: 8 lbs. of sulphate of ammonia, 52,000 cubic feet of 400 B.T.U. gas = 21,000,000 B.T.U. (1 ton of coal = 30,000,000 B.T.U. approximately).

Producers, or Continuous Gas-Machines.—This type is represented by the Siemens and Mond producers. The inventions of these gentlemen represent the two steps of real progress made in continuous gas-machines—*i.e.*, the manufacture of gas by partial combustion with the recuperation of waste heat and saving of bye-products. Dr. Siemens so constructed his producer as to get the very largest percentage of decomposition of carbon dioxide; admixing eventually with the air a small percentage of steam, in order to reduce his temperature, at the same time forming hydrogen and carbon dioxide therefrom. The following analysis by Ritchie is a typical one, and gives the practical working limit of this machine:—

	Per Cent.
CO_2	5·2
CO	24·4
C_2H_4	..
CH_4	2·4
H_2	8·6
N_2	59·4

Heat-value in B.T.U. per cubic foot, 137·23.

The amount of gas produced usually represents, in heating efficiency, from 60 to 65 per cent. of the coal charged into the producer. This type of machine practically supplied the demands for producer gas from 1861 to 1889. There were many modifications; but no great progress was made in the art during this time.

The advent of Dr. Mond's invention marked the second epoch in this branch of gas making. His apparatus produces a higher heat-unit gas per cubic foot, and gives approximately a 20 per cent. better yield per ton, or over 80 per cent. fuel efficiency of the coal charged into the producer. The gas is clean and cold, and can be piped any distance, burning readily cold, as it is very high in hydrogen, and is adaptable to all purposes where fuel gas can be used. Added to this, about 100 lbs. of sulphate of ammonia are produced and recovered per ton of coal; or, putting it more exactly, at least 70 per cent. of the fixed nitrogen in the coal is recovered as ammonia. The machine is nearly automatic, and the composition of the gas changes very little. An average of many analyses from several months' operation gave—

	Per Cent.
CO_2	17·0
CO	11·0
C_2H_4	0·4
CH_4	1·8
H_2	27·2
N_2	42·6

Heat-value in B.T.U. per cubic foot, 156·9.

The material used to produce this was a very poor quality of slack.

The first installation of these producers in America was at Halifax, Nova Scotia; and they are being worked successfully with the Dominion Coal Company's slack, the average analysis of the gas being—

	Per Cent.
CO_2	18·0
O_2	..
CO	9·9
H_2	27·0
CH_4	2·7

Taking the Mond producer as the type of this class, a ton of coal yields, with a very moderate expenditure in labour, 160,000 cubic feet of 156·9 B.T.U. gas, or 25,105,000 B.T.U., and 100 lbs. of ammonium sulphate (1 ton of coal equalling, approximately, 30,000,000 B.T.U.).

Tabulating the results obtained in the different classes, we have, as the products of a ton of coal—

—	Cub. Ft.	Coke.	Ammonia.	Tar.	Benzol.	Cyanogen.
			Lbs.		Galls.	
Coal gas	10,000 (*a*)	1400	5	100	1·5	0·75
Bituminous water gas	52,500 (*b*)	..	2	..	..	..
Mond producer gas	160,000 (*c*)	..	100 (sulphate)	..	..	..

(*a*) 6,000,000 B.T.U.; (*b*) 21,000,000 B.T.U.; (*c*) 25,105,000 B.T.U.

The cost of producing 1000 cubic feet of gas by these different processes (not taking into consideration either the coal used or the products sold, but reckoning only the labour, the interest on the capital investment, and the cost of materials in the operation) is—

Coal gas	5·00 c.
Bituminous water gas	0·90 c.
Mond producer gas	0·62 c.

This gives only the cost value of producing a certain volume of gas with its accompanying bye-products, as given above. The cost of coal and the price obtainable for the different bye-products combine to change these values. These conditions, however, are different in each locality; and cannot be given here. But they can be easily calculated for any place from the above tables.

The last consideration—and it is one of the most important—is the comparative value of the different gases with each other and to the consumer. Taking natural gas as a unit, its comparative value as coal is so thoroughly established in practice that it certainly makes a very accurate standard. Gas is found to be less economical in the generation of steam than for any other purpose. The average of a large number of tests shows that it requires 80 per cent. of the heating value of the coal in natural gas in order to get the same results—labour, repairs, &c., considered. In one test of two months' duration, the heating efficiency of the gas used was 81·67 per cent. of that of the coal to obtain similar results under the same boilers. This is also true of Mond gas, as tests already made give the same evaporation from the gas produced from a ton of coal as burning direct under the boiler. (It has been noted above that the fuel efficiency of the Mond producer is a little over 80 per cent.).

In all other branches of industry, especially iron, steel, and glass, there is required only 40 per cent. to 45 per cent. of the actual heat-units as gaseous fuel as compared with bituminous coal. In domestic use—*i.e.*, cooking purposes and the heating of houses—the economy is still greater. It has been proved by long practice that from 15 to 20 per cent. of the actual heating efficiency of a ton of coal delivered as gas will compete successfully with coal. The above calculations are based on the prices obtained for natural gas and coal in Pittsburg; and the difference in value unit for unit includes all advantages and savings connected with the burning of gas as compared with coal. These results, when tabulated, give—

—	1 Ton of Coal, including all Costs, Firing, Repairs, &c.	Gas Equivalent, including all Costs of Burning.	Percentage Equivalent of Gas necessary to equal Coal.
	B.T.U.	B.T.U.	
Generation of steam	30,000,000	24,000,000	80
General mill use	,,	12,000,000 to 13,500,000.	40 to 45
Domestic use	,,	4,500,000 to 6,000,000	15 to 20

In supplying and consuming gas, it is very advantageous from the manufacturer's standpoint, to have as high a heat-unit gas as possible, on account of the capital invested in mains; while from the consumer's point of view it does not make so much difference, as the higher heating value gases require more air to accomplish complete combustion. The different percentages of air are therefore given below. In these calculations, a definite composition of each of the different gases considered had to be assumed, in order to find the exact amount of air necessary for combustion, as well as the temperature of combustion.

The following analyses have been selected as representative average analyses of each gas considered:—

Natural Gas (Analysis made April, 1897).	Per Cent.	Coal Gas.	Per Cent.	Bituminous Water Gas.	Per Cent.	Mond Gas.	Per Cent.
CH_4	96·9	CO_2	2·2	CO_2	6·83	CO_2	17·0
C_nH_m	0·8	Illuminants	5·2	Illuminants	1·24	CO	11·0
CO_2	0·3	O_2	0·6	O_2	0·20	Illuminants	0·4
N_2	1·2	CO	3·8	CO	29·46	CH_4	1·9
		CH_4	36·5	H_2	48·95	H_2	27·2
		H_2	45·4	CH_4	8·68	N_2	42·5
		N	6·3	N_2	4·64		
	100·00		100·00		100·00		100·00

The quantity of air necessary to burn completely 1 cubic foot of each of the above gases is as follows: Natural gas, 9·80 cubic feet; coal gas, 5·65 cubic feet; bituminous water gas, 2·97 cubic feet; Mond gas, 1·25 cubic feet.

Thetford Corporation and the Gas-Works.—At a recent meeting of the Thetford Town Council, the Town Clerk was authorized to ask the Gas Company if they were prepared to sell their concern; and, if so, at what price. The Secretary of the Company has replied that the Directors are willing to recommend the shareholders to accept the sum of £5500 for the plant, and that the stock of coal and residuals be taken at valuation. The Council last Wednesday referred the matter to a Committee for consideration.

The Cowes Gas-Works Purchase Question.—At a recent meeting of the Cowes District Council, the Special Gas Committee presented a report stating that Mr. E. H. Stevenson, whom they had consulted regarding the purchase of the gas-works, had recommended the Committee to advise the Council to make an offer to the Company of such a sum as he should report the works to be worth. The adoption of the report having been moved, Mr. Richardson said he presumed the price would be laid before the Council previous to anything being done. The Chairman (Mr. G. Fellows) replied that it would not, as the proposition stood. Mr. Lee moved, as an amendment, that the Committee should submit the price recommended by Mr. Stevenson to the Council before an offer was made to the Company. This having been seconded, six members voted for the amendment, and six for the proposition. The Chairman gave his casting vote for the latter, which was therefore carried.

Wages of Driffield Gas Stokers.—The Driffield District Council have not found the management of the local gas-works all plain sailing. Soon after they obtained power to purchase the gas undertaking, they quarrelled with their Solicitor and one of the Engineers engaged in the proceedings connected with the transfer; then they upset the consumers by proposing an increase of 5d. in the price of gas as from Oct. 1 next; and now the stokers employed at the works think it time they should have a little more pay for the hours they have to labour. In making their application for an advance, the men stated that when on night work they have to put in 91 hours a week, and on day work 72 hours. They have also to wheel their own coal and cinders, ash and slack, and then do the necessary yard work. For this they have wages of 26s. per week; while most stokers receive not less than 27s., working on eight-hour shifts, and with men to do the outside work. The Gas Committee are naturally anxious to keep down expenses the first year, so as at the close to show as good a return as possible; and therefore they have decided not to make any alteration at present.

Incandescent Gas Lighting at Sydney (N.S.W.).—In the "JOURNAL" a short time ago, we intimated that the Australian Gaslight Company intended fixing incandescent gas-burners to the public lamps in Sydney. The work has been completed; and we learn that the new lights are giving every satisfaction. The Company have now decided to extend this kind of lighting to the suburbs. The substitution of incandescent for the ordinary burners is in hand, and it is anticipated that by the end of the year the whole of the suburbs as well as the city will be lighted throughout by the new system. There are nearly 10,000 public lamps in the various districts; and the cost of the installation and the maintenance of the mantles is being borne by the Company. We understand that the initial expenses will not be far short of £10,000. The Company are to be congratulated on the enterprising spirit they are showing in the matter of public lighting, and the practical evidence they are giving of their liberality, not only in meeting the large outlay already mentioned, but in so often reducing the price of gas to the public authorities, which must ultimately be of great benefit to the Company in checking the progress of electric lighting in Sydney.

Oil versus Gas for Public Lighting.—The following figures showing the actual cost of street lighting by means of oil are taken from a report presented by the Surveyor at last Tuesday's meeting of the Shepshed District Council. In the abstract before us, no mention is made of the lighting power of the oil-lamps, nor of the gas-lamp with which comparison is made. The absence of this information, and also the price of the gas per 1000 cubic feet, destroys to some extent the interest which would otherwise attach to the figures. During the past year, the quantity of oil consumed was 1735 gallons. The price per gallon was 5½d.; making a total of £37 1s. Glasses and wicks cost £3 15s. 9d.; repairs, £12 15s. 8d.; and labour, £37 19s.—making the total £91 11s. 5d. There were 70 lamps in use; and therefore the average cost per lamp was £1 6s. 3d. A comparison between the oil-lamps and gas-lamp in the Market Place, which was lighted for 70 days, showed that, during this period, 427 gallons of oil were consumed in the 70 lamps. Glasses, &c., cost £1 10s. 7½d.; and repairs, 12s. 6d.—a total of £10 17s. 6d., or an average of ¾d. per lamp per night. The cost of the gas consumed by meter in the lamp in the Market Place during this time was 7s. 6d., or an average of slightly above 1d. per night, which would work out at £1 9s. 4d. per lamp per annum for gas. The price originally quoted by the Gas Company for lighting was £1 15s. per lamp; and they are to be again asked their price.

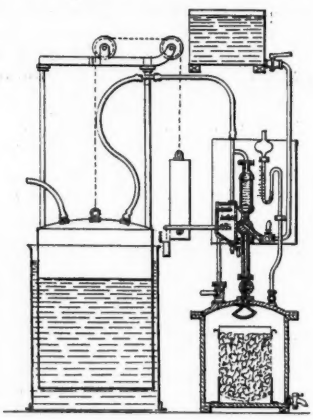
REGISTER OF PATENTS.

Gas-Lamps.—Thomas, T. C. J., and Still, W. M., of Hatton Garden, E.C. No. 16,771; July 29, 1896.

This invention relates to gas-lamps of the kind described in patents Nos. 435 and 22,726 of 1895. The reflector of the lamp in the present arrangement is provided at its lower inner side (near the edge) with a "series of openings arranged above, and in proximity to, the burner or to each burner, which projects inward in a horizontal or approximately horizontal direction towards the centre of the lamp, and below and beyond the lower edge of the reflector; the arrangement being such that the air will issue from the reflector in a horizontal or approximately horizontal direction, and practically parallel to the issuing gas, and, in passing to the gas exit opening or openings in the reflector, will act to keep down the flame or flames so as to impart the desired shape thereto, and prevent it or them coming in contact with the reflector."

Generating and Storing Acetylene.—Fitzgibbon, L. T., of Queen's Gate Terrace, W. No. 17,038; July 31, 1896.

In the apparatus here shown for generating and storing acetylene gas the patentee proposes to employ in combination with a gasholder a device for intermittently distributing the water to the calcium carbide, consisting of a vessel in communication with the holder, with the carbide container, and with a reservoir of water, and of a three-way cock adapted to place the vessel in communication with the reservoir of water or with the carbide—the plug of the cock being operated by the sliding cylinder



of the holder. The carbide container, immersed in a reservoir of water, is divided into an upper and a lower compartment; the lower one being perforated, and the upper one containing the calcium carbide holder, and into which a pipe passes from the lower compartment—the principle of the apparatus being based upon the equilibrium of the pressures in the holder and the carbide container. The employment is also claimed in the production of acetylene gas of "agglomerated balls or tablets, obtained by the admixture of the carbide with stearic acid, paraffin, and the like," and coated with a layer of a substance, such as a silicate, in order to protect the tablets against the action of moisture.

Manufacture of Incandescent Bodies for Illuminating Purposes.—Wheatley, W. H.; a communication from C. Schmid, of Brussels. No. 17,605; Aug. 8, 1896.

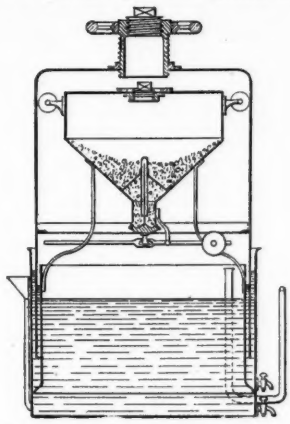
This invention has for its object the production of hoods and mantles for gas or other burners, which by the action of the flame of the burner are rendered incandescent, and thereby greatly increase the illuminating power of the flame. The inventor impregnates the hood or mantle, which may be made of any suitable fabric, with the solutions of salts hereafter specified, the mantle being afterwards subjected to the heat of the flame in the ordinary manner, so that the fabric is consumed while the frame-work, consisting chiefly of the oxides of the metals employed, remains, and when heated to incandescence emits a powerful light. The formula of the solution is as follows (the figures representing parts): Zirconium nitrate, 40; calcium chloride, 15; aluminium nitrate, 10; ammonium nitrate, 29; strontium nitrate, 5; rubidium nitrate, 1. The hood or mantle, having been made of any suitable fabric to the desired form, is saturated in an aqueous solution made according to this formula and dried in the ordinary manner, when it is fit for use, the first application of a flame consuming the fibrous constituent, and leaving only the frame or skeleton of metallic oxides.

Producing Acetylene.—Thompson, W. P.; a communication from D. H. Chivert, of Neuilly-sur-Seine, France. No. 19,059; Aug. 28, 1896.

This invention relates to apparatus in which calcium carbide is employed in the form of grains of a given size; the machine being composed essentially of a water reservoir surmounted by a bell or gas-holder, and of a vessel containing the granules of calcium carbide, the fall of which into the water is regulated by the movement of the bell, which operates a feed-valve arranged on the carbide vessel or container.

The patentee says he has found that, in order to realize the best results, "the calcium carbide must be first crushed and sieved in such a way as to bring it to a condition of granules having approximately the size of a grain of wheat. The feed or fall of granules of this diameter is easily effected, and may be regulated with precision by the valve; and moreover their weight is sufficient to cause them to fall to the bottom of the reservoir, in which the mass of water absorbs the hear developed, and produces a washing of the gas, which ensures its purification. Finally, the small size of the granules allows chemical action to be immediately developed; so that the production of gas ceases immediately the feed of granules is stopped."

The apparatus shown in the engraving is composed of a water reservoir surmounted by a bell, the lower part of which is immersed in an annular chamber filled with water, but independent of the water reservoir, which latter is provided with a supply-pipe, a discharge-tap, and a gas-withdrawal pipe. The calcium carbide container is placed inside the bell, and is supported by brackets fixed to the reservoir. It carries on its upper part rollers which serve as guides for the bell, and is provided in its lower conical part with a valve in the form of a cupel; the spindle being guided in a sheath or holder fixed to the carbide container. The valv is operated by a lever pivoted on a fixed support,



and having at one of its ends a counterweight intended to keep it normally closed. The other end of the lever is sufficiently prolonged to be engaged by an annular projection on the bell. In this manner the bell, which is entirely free in its upward and downward movements, causes, each time it descends, a certain quantity of the granules of carbide to fall into the water, and consequently the production of a corresponding volume of gas, which then forces the bell to immediately rise. The valve at once closes under the action of the weight; and the production of acetylene is arrested until the consumption of the gas causes the bell to again descend, and bring about a fresh fall of carbide into the water.

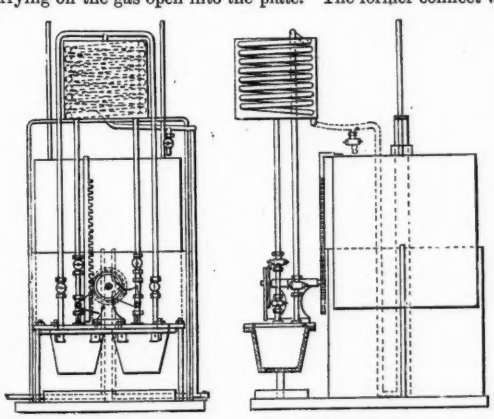
Gas-Lamps.—Beal, W., of Birmingham. No. 18,253; Aug. 18, 1896.

This invention has reference to gas-lamps in which the burners are carried by downwardly projecting tubes, and contained within a glass globe, the top of which has usually been attached to, and carried by, the underside of the shade, which in some cases forms the bottom of an air-shaft in the ceiling. In order to carry the globe so that it can at any time be drawn down for lighting or extinguishing or for cleaning, without possibility of the gas escaping, the patentee proposes, where the guide of the globe slides in the lower end of the vertical tube, to make one of the vertical tubes a dummy—that is to say, it is closed so that the gas only comes down the other vertical tube to the burner; and this last-named tube is made with another smaller tube inside it, the top end of which is closed. It is fixed to the bottom of the gas-tube, so that the gas passes down the annular space between this inner tube and the outer tube—the slide of the globe moving up and down the inner tube. As there is no access for gas into the latter, it is not necessary to have a gas-tight joint where the slide works in it.

Producing Acetylene Gas.—Voigt, G., of Berlin. No. 19,126; Aug. 29, 1896.

This invention, relating to apparatus for producing acetylene gas by the action of water on calcium carbide, has for its object "a convenient handling, a simple and automatic arrangement, and an exact regulation of the supply of water to the carbide receptacles."

As shown, frames or supports and a gasholder are mounted on a bed-plate. The one frame carries a plate to which the carbide receptacles are air-tightly attached, in such a way as to be easily removable, and so that the plate forms the cover of the receptacles. Water-feed pipes and pipes for carrying off the gas open into the plate. The former connect with a



reservoir which supplies the water for developing the gas; and the water also cools the gas passed through a worm immersed therein. The feed-pipes through which the water trickles on to the carbide have each an ordinary stopcock, to be closed by hand, and also a second cock operated by gearing from the holder.

This gearing may consist of two sectors mounted on the spindles of the cocks to be operated, and so curved on its periphery at two parts as to embrace a revoluble disc held thereby in one or other of two positions, but without preventing the rotation of the disc. The disc has a stud or pin in front of a recess formed in it, which pin engages in a slot formed in the sectors, in order to carry the latter to right or left along with it. On the spindle of the disc is mounted a cogwheel to engage with a rack firmly connected with the holder, and so adapted as to operate the cocks according to the position of the bell.

The operation is as follows: When the bell is in its lowest position—that is to say, when the supply of gas is small—water from the reservoir trickles on to the calcium carbide as soon as the stopcocks are opened. Acetylene gas is then developed, which is cooled by the worm, and, if necessary, purified, and flows under the gasholder bell, which rises and, at a given position, by means of the gearing, closes simultaneously or in succession the other cocks. The supply of water to the carbide vessels is thereby interrupted; and during the subsequent development of the gas, which causes the bell to rise still higher, the cocks are kept firmly closed. When so much gas is consumed that the bell has descended sufficiently, the water supply is again opened, and the development of gas commences afresh.

Producing and Storing Acetylene Gas.—Morton-Brown, E. A., and Maundrell, F., of Woodstock. No. 22,628; Oct. 12, 1896.

The object of this invention is "to devise an automatic apparatus for the production and storage of acetylene gas, which will be both efficient, economical, and safe." It consists, essentially, of a generator, in which the decomposition of the calcium carbide is effected in a rotatable perforated or open-work cylinder, by the rotation of which the lime is shaken from the surface of the carbide, of a condenser located in the water-tank of the gasholder, of automatic apparatus for regulating the water supply and for shutting it off when the gas supply to the holder ceases, and of "such other improvements as are hereinafter more particularly described and then definitely claimed." For this purpose, the patentees deem it essential to provide nearly eight pages of printed specification, with a sheet of detail drawings. There are 31 claims for the invention.

Valves or Taps and Couplings for Gas-Fittings.—Hodkinson, J. & T., of Burton-on-Trent and Nottingham. No. 23,857; Oct. 27, 1896.

The object of this invention is to provide a combined valve and coupling by which the supply-pipe is opened or closed automatically upon the insertion or withdrawal of the burner part, and by which a gas-tight joint is formed between the burner part and supply-pipe when the former is inserted in the latter. The supply-pipe is provided with a fitting which comprises a part shaped to form a portion of the coupling; a coned part corresponding to a similar part on the burner part, to form the gas-tight joint; and a valve which is held up to a suitable face by a spring. The end of the burner pipe is provided with a fitting screwed to form part of a coupling, and coned to fit the corresponding parts in the supply-pipe fitting. In addition, the burner pipe fitting is arranged to open the valve in the supply-pipe fitting when the two fittings are brought together. When the improved fitting is used in exposed places (such as markets), the tap of the supply-pipe fitting is provided with a cap or plug.

Incandescent Gas Mantles.—Moll, R., and Palmer, A., of Freyburg, Germany. No. 26,784; Nov. 25, 1896.

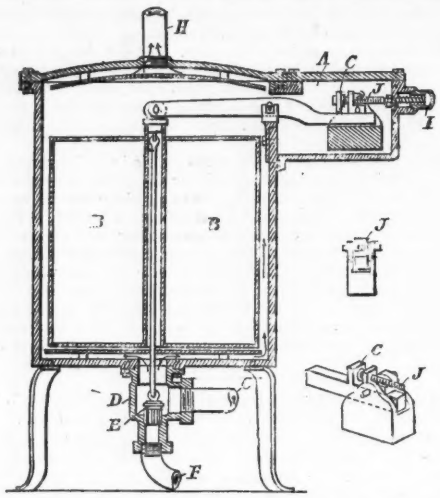
These mantles, of "greater capacity for resisting concussion," are prepared by the employment of salts having thorinum for their base, only differing from other methods in the use of proportionately smaller quantities of such materials. Instead of cerium, or salts based thereon, are substituted natrium or natrium salts, simultaneously employing silicates or borates. The usual method is followed of impregnating the mantles with a watery solution, in the preparation of which chemically pure chloride of sodium and soluble alkaline silicate are used, together with only about 30 per cent. of nitrate of thorinum, instead of the larger percentage of the latter material formerly employed under similar conditions. The use of cerium is entirely dispensed with. Other materials may be added—such as arsenical compounds—and the quantitative relation of the component parts may be varied according to the quality of incandescent appliances to be produced.

Automatically Regulating the Carburation of Gas.—Frost, E. J., of Philadelphia, and Middleditch, B., of Michigan, U.S.A. No. 4870; Feb. 23, 1897.

This invention relates to an arrangement to effect the proper (but not over) saturation of gas with gasoline vapour used in a carburettor.

The mixing chamber of the carburettor [see next page] has an extension A and a sealed float B, preferably of cylindrical form, connected with one end of a lever provided with a bifurcated counter-balance supported by a pivot resting on bearings in a travelling block, which in turn is supported on the outer end of the lever. C is an upward projection, or lug, on the lever forming a bearing for a screw for the adjustment of the counter-balance. D is a casing containing the seat on which the valve E rests when closed. F is the inlet through which air is supplied at a pressure equal to, or greater than, the pressure of the incoming gas; G is the gas-inlet; and H the outlet leading to the burners.

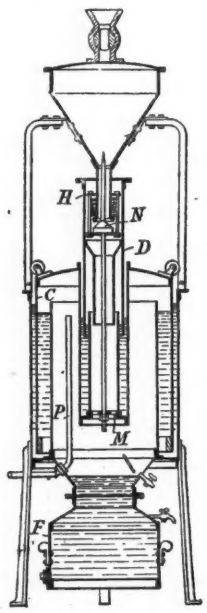
When in operation, the float and counter-weight are initially adjusted relative to each other, so that the valve E controlling the air-inlet is closed, and remains so when vapour of just the desired richness (or less) is passing from the carburettor into the gas-inlet G, and through the cylinder to the burners. As soon, however, as the vapour current becomes too highly saturated, the increase of its density lifts the float B, and with it the air-inlet valve; at the same time correspondingly depressing the counter-weight. This admits air to the mixing chamber through the inlet F to dilute the vapour in the chamber; and (when gas is being drawn from the mixing chamber) the float varies the position of the valve E in accordance with the quantity of air required from time to time—thus keeping the vapour within the mixing chamber at practically a constant density, and ensuring gas of even quality. Sudden variations in the number of lights supplied from the mixing chamber may cause the float to open the valve wide, or to close it entirely; but ordinarily when the apparatus is in use, the admission of



air is continuous, but regulated, until the gasoline in the carburettor becomes nearly exhausted of its lighter constituents. The counter-weight on the outer end of the lever is movable longitudinally, and can be adjusted by removing the cap I, pushing inwardly the rod until the socket on the inner end of it engages with the threaded rod J.

Manufacturing Acetylene.—Cousin, H., of Paris. No. 8552; April 3, 1897.

This apparatus consists of the following main parts: 1, A hopper containing a supply of granulated carbide; 2, a device for regulating the supply of carbide from the hopper to the generator; 3, a gasholder; 4, a generator containing the water or liquor and collecting the deposit; 5, a purifier.



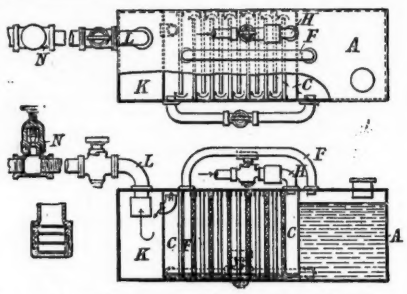
The hopper consists of a funnel-shaped receptacle closed on the top and fitted with a cock, through which the hopper is charged with carbide. The hopper is supported by the guides of the gasholder bell fixed upon the holder tank, so that the bell has not to support the hopper. The holder consists of an annular tank with the floating bell C, and a smaller bell D fixed to the flange of a pipe attached to the bottom end of the hopper. The lower end of D dips into the annular hydraulic seal tank formed by a down pipe riveted to the crown of the bell C at the top, and joined by a Z iron to the rising pipe. The bottom of the gasholder tank is conical, with a pipe at the centre, to which a bottle-shaped generator F is bolted, to contain the water for decomposing the carbide and collecting the deposit of lime.

The device for regulating the supply of carbide to the generator F is arranged as follows: A square frame is formed of a plate H or its equivalent, surrounding the pipe inside the bell D, and connected to another cross-bar which has formed on it, or carries, a conical valve N. Between the flange of the valve seating and the plate H a helical spring is compressed, so that it has a tendency to lift the frame and valve and close the orifice of the pipe. To the valve or plate a rod is fixed threaded at its bottom end, with a nut screwed upon it. The rod passes freely through a hole in a cross-bar M fixed in the pipe of the hydraulic seal. The nut is so adjusted that, when the bell C is in its lowest position, the valve fully opens the outlet orifice from the hopper. The rod is prolonged upwards to agitate the carbide in the hopper, and prevent it sticking. When the bell C rises, the spring lifts the valve N against its seating, and closes the outlet; after which the bell can continue to rise freely to its highest position.

At starting, the bell is lifted and held up so that the valve N is closed. Granulated carbide is filled into the hopper, which is then closed. Water is filled into the generator F till it overflows the edge of the inner wall of the centre hydraulic seal. When the bell drops, the cross-bar M encounters the nut, and draws the valve down, allowing carbide to fall through the bell D into the generator F, and gas is produced and fills the holder. It is drawn off for consumption through the pipe P or led to a purifier. If the production is greater than the consumption, the bell C rises, and the spring closes the valve, whereby the production of gas is stopped or reduced till the bell sinks down again, when the cross-bar again strikes against the nut, and the valve is pulled open by the bell, allowing a further supply of carbide to drop into the decomposing chamber.

Carburetting Air.—Buck, G., of Earl's Court, W., and Torrey, E. S., of King's Cross, W.C. No. 9929; April 20, 1897.

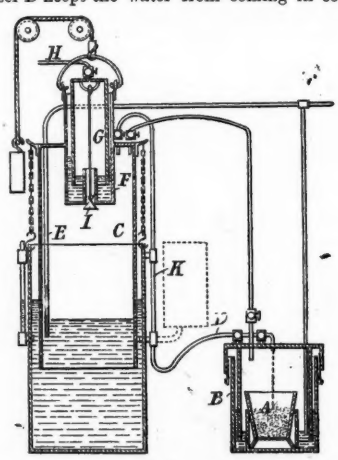
The arrangement of apparatus shown is specially designed for use with an explosive engine. It consists of a chamber A for containing the liquid hydrocarbon and C the carburetting chamber. A horizontal pipe connects the chambers at their lower ends; and a pipe F passes from near the bottom of the chamber C upwards through the chamber, and opens into the top of the chamber A. Tapes or wicks hang from the top of the carburetting chamber to the bottom, and are connected alternately to the opposite sides of the chamber, so as to leave a space alternately on either side to form a baffle arrangement for the air passing through. H is the air-inlet pipe to the carburetting chamber; and J the outlet for the carburetted air from C. The outlet opens into the chamber K from which it is drawn, by the suction of the motor piston, through the pipe L. N is a regulating-valve through which air enters to mix with the carburetted air to form the explosive mixture as the carburetted air passes to the motor. In practice, it is found advantageous to provide the filling plug of the chamber A, the air-inlet pipe H, and the carburetted-air outlet-pipe L with chambers containing gauze for guarding against the risk of explosion. One of these chambers (shown in section) consists of a series of gauze discs held in a cylindrical casing and separated by distance pieces.



When the cock on the pipe H has been turned so as to allow air to flow into the chamber C, and the container A has been filled with petroleum, a quantity of it will flow into the chamber C until the level in it has risen sufficiently to cover the lower opening of the pipe F, when the flow ceases, as no air can now pass through the pipe into the chamber A. The tapes or wicks absorb the petroleum, and the air entering through H passes through the carburetting chamber C in a zig-zag course, so as to come into contact with a large surface of petroleum. The air thus carburetted then goes into the chamber K, and thence into the pipe L, through which it flows, drawing in air through the valve N in its passage to the engine. A fresh supply of petroleum enters the chamber C when the air flowing through the chamber has absorbed a sufficient quantity of petroleum to have lowered the level of the liquid in the carburetting chamber below the outlet of the tube F.

Generating Acetylene Gas.—Morency, D. C., of Levis, Quebec, Canada. No. 10,186; April 23, 1897.

In this arrangement of apparatus, the vessel A contains the carbide of calcium from which the acetylene is formed by the addition of water according to the well-known reaction. B is a vessel open at the bottom, and arranged over A; the water in B making it gas-tight. An inner wall in the vessel B keeps the water from coming in contact with the



vessel containing the carbide. C is the gas receiver consisting of a vessel open at the bottom, and slidable vertically in a vessel which contains water with chloride of sodium or chloride of calcium, or any other liquid such as oil or molasses. A pipe connects to the top part of the gas receiver. K is a transparent tube or glass gauge; and the flexible water-pipe D has a nozzle which projects upwardly within this tube. The

liquid in the tube K always stands at the same height as the liquid in the gas receiver C. E is an escape-pipe for the gas in the vessel C should the pressure become excessive. F is an outer vessel having no top, and secured to the top portion of the gas receiver C. A tube projects upwardly from the bottom of the vessel F. G is a vessel which has no bottom, and which is slidable in the vessel F. The vessel F contains water, so that the vessel G is gas-tight. H is the gas distributing-pipe connected to the upper part of the vessel G. I is a conical plug valve, suspended from the top of the vessel G by a rod or cord.

The water passes from the main vessel down the pipe D to the carbide; and the gas is at once generated. It passes into the receiver C, through the valve I, and into the vessel G. When the gas enters the vessel G faster than it passes off by the pipe H, the vessel G is raised by the pressure of the gas accumulating inside it, and the valve I is closed. When the pressure of the gas increases in the main vessel, it depresses the water in it and in the tube K; and as soon as the level of the water is below the top of the nozzle, the supply of water to the carbide is cut off automatically, so that no more gas is formed.

Carburetted Water-Gas Apparatus.—Humphreys, A. C., and Glasgow, A. G., of Victoria Street, S.W., and of New York. No. 11,131; May 4, 1897.

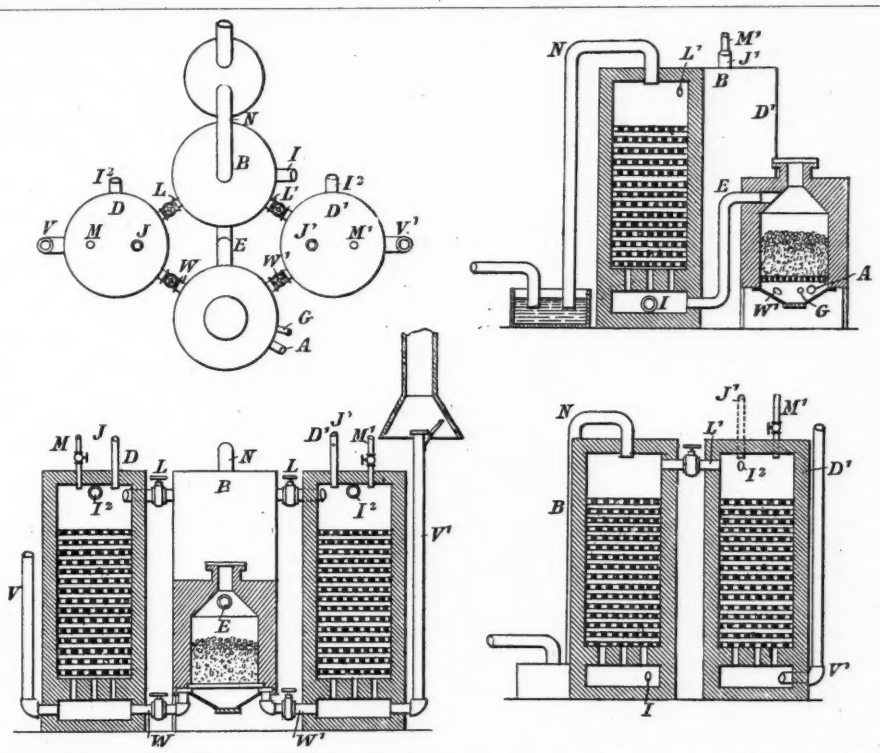
This invention has for its object to provide apparatus for manufacturing carburetted water gas which will allow of the utilization of the heat generated in the blowing-up stage of the process.

In reference to their proposal, the patentees say: "The desirability of preheating the air-blast used to promote the combustion of fuel in a water-gas generator has been generally recognized; but the various plans that have been devised for heating the air have failed to attain practical success, or to go into general use. We have ascertained, however, that in the manufacture of carburetted water gas the products of combustion given off from the generator during the operation of blowing up contain, after passing through the carburetting and fixing chambers, sufficient sensible and potential heat to impart to the air-blast a temperature so high as to materially shorten the time required in blowing up the generator and heating the regenerative chambers; and we have discovered that this waste heat can be utilized for preheating air and superheating steam as well as by providing, in addition to the regenerative chambers used for carburetting and fixing the gases, two supplemental regenerative chambers connected in series with the fixing chambers, so that the products of combustion will pass from the fixing chamber through either supplemental chamber at will—the said supplemental chambers being also independently connected to a source of air supply and to the generator, so that air can be forced through either of them to the generator; steam-pipes being also preferably provided so that steam can be forced through either supplemental chamber to the generator."

The illustration shows a plan of an arrangement suggested; also various sectional elevations of the plant.

The water-gas generator is preferably provided with a cold-blast connection A, and with saturated steam connections G—the use of these connections being at times desirable in trimming and adjusting the fire and heats throughout the apparatus. B is a regenerative carburetting and fixing chamber connected by a conduit E with the generator. D D^1 are supplemental regenerative chambers connected by conduits L L^1 with the carburetting and fixing chambers, and having a gas escape at V V^1. W W^1 are conduits leading from chambers D D^1 to the generator. To keep such a heat in the top as not to condense the steam, it will probably be necessary to admit the blast at several points along the height of D D^1. J J^1 are air-blast conduits leading into D D^1; and I I^1 I^2 are air-blast conduits leading from a source of supply to each of the regenerative chambers, for the purpose of promoting the combustion of the fuel gas during the blowing-up operation. M M^1 are steam-pipes leading into the chambers D D^1.

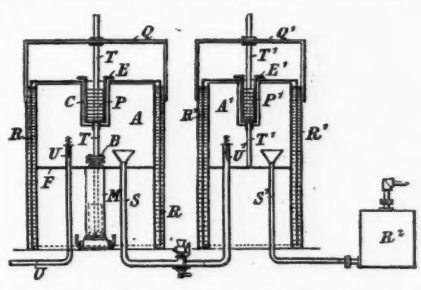
The operation carried on in this apparatus, assuming it to be preheated to operative temperatures, consists in blowing up the generator by passing air from J into the supplemental chamber D—the heated blast passing through the conduit W to the generator. The products of



combustion from the generator pass through the conduit E to and through the carburetting and fixing chamber B, or B and C, to the other supplemental regenerative chamber D^1. The potential heat of the products of combustion is utilized by introducing air in the various regenerative chambers through which the gases pass by the conduits I I^2; and the air so introduced may, of course, be a part of that preheated in the supplemental regenerative chamber. The apparatus being sufficiently hot, the air-blast is cut off, and steam is introduced, preferably through the pipes M to the supplemental chambers D; and having been superheated therein, it enters the generator, from which the water gas passes to the carburetting and fixing chambers, where it is enriched by oil, the carburetted gas passing off through the conduit N. Then air is forced in from (say) the conduit J^1 to the supplemental chamber D^1; passing thence heated to the generator, while the products of combustion are led off through the carburetting and fixing chamber to the chamber D, and escape thence by the flue V. Afterwards steam is forced through the chamber D^1 to the generator; the gas carburetted and fixed as before; and the alternating operation continued indefinitely.

Supplying Gas under Pressure to Incandescent Gas-Burners.—Abeele, F. van den, of Brussels. No. 11,252; May 5, 1897.

This apparatus consists of a small gasholder so arranged that in descending it will force back the gas by its own weight in the usual way, but in its upward motion is assisted by motor mechanism, adapted to co-operate with the gas admitted, mainly in overcoming the load in excess applied to the balancing-weights, whereby the compression taking place as the dome of the holder descends is increased. A number of compressing domes may, if desired, be coupled to one regulating or controlling dome common to them all—in which case each compressing dome would be seconded in its operation by the motive power alluded to; while, on the other hand, the arrangement may be confined to one motor dome only, in combination with a second dome unprovided with motor mechanism. It is this form of apparatus which will be described by way of example, with reference to the accompanying illustration.



A is the main dome fed from the works through the mains U. It is immersed in an annular water-tank R, centrally divided by a partition or diaphragm F, forming the bottom of the movable dome A, integral with the top of which is the inner cylinder C, into which is inserted a stirrup

or yoke E carrying the over-loaded weights P. A rod T secured in the cylinder axially serves to guide the dome at the top; being, to this end, passed through a cross-piece Q. The top of the main U, rising above the diaphragm F, is closed by a valve, subjected to the pressure of a spring of small power, and adapted to open under the pressure normally prevailing in the main. The outlet-pipe S, opening also by the diaphragm F, is not fitted with any means for closing it; and therefore it at all times remains open.

In juxtaposition with the main dome, there is erected a secondary dome, identical with the other as regards shape; the only difference being that in this case the pipe S becomes the inlet-pipe U^1, while the pipe S^1 is connected with the mains supplying the burners with gas, with the interposition of a small regulating reservoir R^2. In the centre of the tank R, and below the dome A, is located the source of motive power, which, in the present instance, is assumed to be a single-acting hydraulic engine M, the piston of which is secured to the rod T which is guided by a stuffing-box B. The engine is connected, through a distributing or supply cock, to the water-main; pressure to the extent of a few atmospheres being applied. In view of the fact that the volume of the dome A is somewhat in excess of that of the dome A^1, and that the sectional area of the pipe-connection S U^1 is a little larger than that of the outlet-pipe S^1, when the dome A, loaded with the weights P, rises by the aid of the motor engine M, it fills with gas from the main U. When it has arrived at the highest point it is capable of reaching, the engine reverses its distribution, the water is discharged, and the dome descends. In doing so, it compresses the gas both by its own weight and by the weight of the over-load P, and forces the gas into the dome A^1 weighted with a somewhat less load P^1, which in its turn will be raised, but without the assistance of the motor apparatus, and merely by reason of the increased pressure owing to the weight P. In re-descending, the dome A^1 forces the gas into the mains under practically the same pressure; causing it to pass first through the regulating chamber R^2, whereupon the same cycle of operations is repeated.

APPLICATIONS FOR LETTERS PATENT.

17,527.—Ahrendt, H., "Electrical gas-lighting devices." July 26.

17,569.—Everson, J., and Williams, T., "Steam boxes for gas-producing chambers." July 27.

17,644.—Lake, H. H., "Apparatus for purifying gas by washing or scrubbing." A communication from Fellner and Ziegler. July 27.

17,654.—Ghinste, R. Van de, "Mantles or fabrics for incandescent lighting." July 27.

17,672.—Harnett, G. H., and Campion, A., "Automatic gas supplying machines." July 28.

17,679.—Clay, W. R., "Incandescent gas-burners." July 28.

17,711.—Brown, C. B., "Valve for automatically regulating the flow of gas into the burners or burner-ring of ordinary cooking-stoves and the like." July 28.

17,749.—Lewes, V. B., "Manufacture of illuminating gas." July 28.

17,793.—Kitchen, J. G. A., "Acetylene generators." July 29.

17,794.—Kitchen, J. G. A., "Acetylene generators for portable lamps." July 29.

17,813.—Dumont, P., "Acetylene apparatus." July 29.

17,819.—Sheldrake, J. H., "Improvements connected with street or outside gas-lamps, and in the arrangement of unprotected incandescent mantles therein." July 29.

17,835.—Pringle, R., "Gas cooking-stoves." July 29.

17,844.—Muratet, H., and Bessac, J., "Acetylene gas generators." July 29.

17,854.—Hacking, L. A., "Safety appliances for gasometers." July 30.

17,883.—Rousselet, R., and Labrousse, A. de, "Acetylene gas generators." July 30.

17,938.—Rieffel, A., "Production of acetylene gas." July 30.

17,971.—Albrecht, A., "Lamp burners for incandescent light." July 31.

17,976.—Gobbe, E., "Manufacture of gas and the obtainment of by-products therefrom." July 31.

18,005.—Thompson, W. P., "Producing heating or lighting gas by the aid of volatile hydrocarbons." A communication from A. Julien, Belgium. July 31.

18,023.—Winkler, H., "Cocks for gas lamps or lanterns." July 31.

18,056.—Imbert-Rolland, P., "Acetylene gas-generators." Aug. 3.

18,063.—Boydell, T., "Gas or oil lighting, heating, and cooking apparatus." Aug. 3.

18,085.—Young, W., and Bell, A., "Carbonization or destructive distillation of coal and production of carburetted water gas." Aug. 3.

18,089.—Münsterberg, O., "Burners for acetylene and like gases or liquids." Aug. 3.

18,090.—Münsterberg, O., "Gas and liquid taps and connecting-pipes." Aug. 3.

18,100.—Gill, J., "Rotary motive power engines, pumps, air or gas compressors, and meters." Aug. 3.

18,106.—Johnson, J., "Gas-stoves." Aug. 3.

18,127.—Wise, W. L., "Gas-generators." A communication from G. P. Fisher, jun. Aug. 3.

18,197.—Lanchester, F. W., "Ignition arrangements of gas and oil motor engines." Aug. 4.

18,218.—Smith, F. H., "Preparation of calcium carbide and the like for use in gas-generators." Aug. 5.

18,228.—Marsh, S., "Fire screen or mantle." Aug. 5.

18,233.—Goodwin, F. C., "Improvements in rotary fluid meters." Aug. 5.

18,258.—Streatfeild, R. J., "Coin-freed apparatus for enabling a supply of water or other liquid to be obtained." Aug. 5.

18,289.—Urquhart, R. J., "Ignition of gas-lights by means of electric sparks." A communication from the Actiengesellschaft für Fabrikation von Broncewaaren und Zinkguss. Aug. 6.

18,345.—Webb, G., jun., Kelly, J. W., and Rountree, H., "Production of carbide of calcium." Aug. 6.

18,353.—Fritz, F., "Gas lighting apparatus." Aug. 6.

18,355.—Bull, J. C., "Manufacture of acetylene gas." A communication from Jossé and Defays. Aug. 6.

18,360.—Daubenspeck, G., "Refractory incandescent mantles or hoods." Aug. 6.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Gaslight and Coke Company.

Sir,—At the close of your leading article in this week's issue, on the history of The Gaslight and Coke Company—which, whether one is able or unable to accept all its deductions and conclusions, is an interesting *résumé* of the Company's later career—you give, as an example which justifies your "unkind hint" last February that I did not understand the figures which I presented to the meetings of shareholders, my reference to the protection of the dividend, if necessary, by increasing the price of gas; and you imply that I suggested that the present dividend could be "maintained by the simple expedient" of raising the price. I beg to say I never made any such suggestion.

You appear to forget that "the dividend" in the case of our Company is the statutory dividend at the rate governed under the sliding-scale by the price charged for gas, and that, if the reserve fund were allowed to be too much depleted before the price was raised, the dividend at the reduced rate might, for the time being, be endangered. If the estimates for future working showed any such possible deficit, we should not, as I stated, hesitate to increase the price. The shareholders, I am convinced, perfectly understood what I said; and I cannot understand how you could have fallen into the error of suggesting that I uttered such nonsense as you impute to me.

Aug. 12, 1897. W. T. Makins.

[We are obliged by Colonel Makins's appreciation of our *résumé* of the later history of The Gaslight and Coke Company. With reference to his explanation of his remarks at the meeting on the subject of the price of gas and the dividend, we must leave our readers to judge, after seeing the report given last week (pp. 334-37), whether or not we were correct in our estimate of the character of these observations. The statement coming from the chair that "they could not justify the raising of the price of gas at the present time, the effect of which would be *merely* to swell the reserve fund," struck us as being unfortunately incomplete. The connection between any alteration in the price of gas and the rate of dividend payable, is so intimate that no official mention of the one without equal prominence being given to the other consideration can be free from the risk of being misconstrued—Ed. J.G.L.]

The Manufacturing Wages of The Gaslight and Coke Company.

Sir,—The "Journal" for the 10th inst. has been sent on to me here; and, with reference to your note at the foot of my letter, all that I would ask you to do is to place side by side my remarks at the Engineering Conference (to which you have drawn attention) and your own editorial comments on the manufacturing wages of The Gaslight and Coke Company. I have no doubt that your own good sense will then show you that you cannot deduce one from the other.

In the first place, the further introduction of machinery in the retort-house which is in contemplation will have the effect of bringing down the carbonizing wages; and the increase in the water-gas plant will also operate in the same direction. But you appear to have drawn a different conclusion, though by what process of reasoning I am at a loss to understand.

Grindelwald, Aug. 14, 1897. G. C. Trewby.

Gas-Testing in London.

Sir,—The Chairman of the London County Council, in his recent annual address to that body, again raised the old and well-worn "bogey" that the gas supplied to the Metropolis was very much under the parliamentary standard of 16 candles. It appears that the Chairman of the Council based his statement on the authority of a report made by Mr. W. J. Dibdin, the Chemist to the Council, to the effect that he had made "continued further tests with the portable photometer at points other than the fixed stations; and he found that a large quantity of the gas was considerably below the standard of illuminating power—amounting in some cases to 2 or 3 candles, and that he had come to the conclusion that the effect of the present mode of enrichment is only partial, and confined to the proximity of the testing-places."

This, Sir, is an old subject; and it would hardly be worth noticing, but for the fact that some of the public papers think that "such a very serious statement needed an investigation," and suggest "that it should commence at the portable photometer." Further, Colonel Makins, the Governor of The Gaslight and Coke Company, in his last address from the chair, at the half-yearly meeting of shareholders, expressed in the most indignant terms his horror at the fact that the London Companies were charged by the Council with "defrauding the public."

Well, Sir, this is the charge made by Mr. Dibdin. Some of us had hoped that the matter had been laid at rest by the exhaustive discussion that took place last year (in the "Journal") between Mr. George Livesey and Mr. Dibdin; but as Mr. Dibdin seems determined to keep the matter alive by renewed attacks on the Companies, I would suggest that an investigation should be made by the Gas Referees, and one or two representatives of the Gas Companies, as upon both these bodies the reflection is equally serious.

The whole of this discussion hinges upon the meaning to be placed on a clause in the Gas Act of 1869, which reads as follows: "Gas supplied to the public shall, when burning through a Sugg's No. 1 'London' argand burner at the rate of 5 cubic feet an hour, be equal in illuminating power to 16 standard sperm candles burning at the rate of 120 grains an hour."

In explanation of this clause in the Act of Parliament, the Chairman of the South Metropolitan Gas Company says: "I hold that Parliament intended the gas to be of the prescribed quality of 16 candles, at the testing-stations, and not necessarily at the consumers' burners." The Chairman clinches this argument by the following further statement: "Gas is always required by Parliament to be tested by samples

taken from the bulk, as it goes into the district—not by tests made at the extremities. It has always been recognized that gas loses in illuminating power by travelling. Consequently, in order to obtain 14 or 15 candles for the consumers, Parliament prescribed 16 candles at the testing stations. If Parliament had intended the consumer to have 16 candles, the standard would have been fixed at 17½ or certainly at 17 candles. The Companies supply on an average 16¼ candles."

In contradistinction to this opinion, the Chemist to the Council contends "that it was the intention of Parliament that the bulk of the gas should be equal to an illuminating power of 16 candles at the burners of the consumers."

To make matters clear, it may be stated that, to ensure the carrying out of the provisions of the Act quoted on the part of the Companies, the Board of Trade appointed three Gas Referees (one of whom was the late Professor Tyndal) to prescribe the "mode," "times," and places of testing; and these gentlemen have caused to be established twenty-three testing-stations in various parts of London, which are placed under the control of the London County Council, and the Corporation of the City of London. At each of these stations, a Gas Examiner, appointed by one or other of these bodies, makes daily three tests for illuminating power of the gas from the supposed bulk; and this legally determines the quality of the gas sent out by the Companies each day.

In the event of the gas being found equal to the parliamentary standard of 16 candles at the testing-stations, the responsibility of the Companies ceases. Should, however, the gas be found below the standard, the Company at fault incur a penalty, unless they succeed (on appeal) in proving to the satisfaction of the Chief Gas Examiner—another impartial officer of the Board of Trade—that it arose from some "unavoidable cause."

These regulations appear sufficiently stringent, and led one distinguished authority to remark, that "London gas was the most severely tested in the world." It seems difficult to believe that the first Gas Referees did not take into consideration the spirit as well as the letter of the Act when they framed these stringent regulations. Indeed I know that they did. I had abundant opportunities of proving this; having been in constant communication with the original Referees when the Act was first passed, and afterwards for more than twenty years one of the Gas Examiners. I also am able to say that the arrangements for testing made by the Referees met with the approval of the late Mr. T. W. Keates, the Consulting Chemist and Superintending Gas Examiner to the Metropolitan Board of Works, and of Mr. C. Heisch, the Chief Gas Examiner to the Corporation of the City of London—two of the fairest minded men I ever knew, and both of whom were deeply solicitous that gas consumers should get what they were entitled to. This was before Mr. Dibdin knew anything about gas, or the portable, or any other photometer.

The system adopted by the Gas Referees in 1869 has worked well; and comparatively few prosecutions have taken place for deficient illuminating power. Indeed, against one Company no summons was issued for nearly fifteen years. It would, therefore, appear that there has been but little ground for complaint.

It must I think be about two or three years ago that Mr. Dibdin commenced his crusade with the portable photometer; and after making a large number of tests at Board Schools, Fire Stations, and other places, he discovered that the gas supplied to the public was 2 or 3 candles below the standard. He embodied this opinion in a report to the Council. Mr. George Livesey thereupon took up the cudgels on behalf of the Companies; and for some time the matter has rested. It would probably have continued to rest but for the recent deliverance of the Chairman of the London County Council.

This conflict of statement as to the meaning of an important clause in an Act of Parliament is a very serious one. But, looking at the matter closely, there cannot I think be the shadow of a doubt that the Legislature intended that gas should be tested from the bulk at fixed stations, where the ventilation and other matters could be properly controlled, and not at remote and out-of-the-way places with a machine on a wheelbarrow.

After a very long experience, even with the perfect instruments made by Messrs. Sugg and Co., I have little faith in photometrical experiments; and when they are made with a portable photometer I have none at all. Judging from my own experience, as well as that of other well-known experts (whose names I am prepared to give), there is often a difference of 2 or 3 candles between them.

Although it is known that gas will sometimes lose by travelling long distances, this is by no means always the case. I have assisted in testing gas that has travelled more than ten miles without any loss. It is my opinion, therefore, that the difference in illuminating power must mainly be placed to the account of the portable photometer.

I am entirely in favour of a fair testing of the gas; but I am not in favour of disturbing the present arrangements. These have already cost the public nearly £350,000—money spent to gratify a "whim" of the Chemist to the London County Council.

It is a significant fact that, although the Chemist to the Council was for a lengthened period a Gas Examiner, it has taken him nearly fifteen years to discover that the present method of testing gas is unreliable; while the Board of Trade officials, who are responsible for the arrangements, do not appear to have discovered it at all. Verily, there is "another Daniel come to judgment."

J. V. Taylor, F.C.S.,
Twenty Years Gas Examiner to the Metropolitan Board of Works and the London County Council.

342, *Strand, W.C., Aug.* 13, 1897.

Water-Works for King's Teignton.—The works for providing a supply of water for the little Devonshire town of King's Teignton were completed on Saturday week. The water is derived from the spring known as the Holy Well, in Ugbrooke Park, the seat of Lord Clifford. This is situated at an elevation of 250 feet above the village; and as the volume of water is five or six times the quantity required for an ample supply, it is carried to every part of the place by gravitation without the aid of a reservoir. The scheme was originally opposed by the inhabitants, but it promises to be very popular in the town, which has hitherto suffered from periodical outbreaks of typhoid fever.

PARLIAMENTARY INTELLIGENCE.

POLICE AND SANITARY REGULATIONS COMMITTEE.

Tuesday, July 20.

(*Before Mr.* W. G. Mount, *Chairman, Mr.* H. J. Wilson, *Mr.* J. Hutton, *Mr.* T. R. Leuty, *Mr.* M'Kenna, *Sir* H. D. Bemrose, *and Mr.* D. Cox.)

BRADFORD CORPORATION BILL.

This Bill, which, *inter alia*, is to extend the period for the compulsory purchase by the Corporation of Bradford of lands for water-works purposes under their Acts of 1890 and 1892, and to make further provision with regard to the water-works undertaking and the sinking funds to be created by virtue of those Acts, was under consideration to-day. Certain objections had been raised to portions of the Bill; but the opponents were not represented by Counsel.

Mr. Balfour Browne, Q.C., in opening the proceedings, dealt first with the portion of the Bill relating to the water-works. He said that in 1892 Bradford found that its water resources were coming near their end. They therefore very wisely determined to go a great distance—to the valley of the Nidd—for the purpose of constructing new works for the supply of the town and neighbourhood. These works would cost something like £1,300,000 sterling. There were some portions of this part of the Bill which, though not opposed, it would be necessary for him to deal with, because of some criticisms made by the Local Government Board. For one thing, the Corporation wished for more time for the construction of some of the large reservoirs at the head of the valley; and they asked for five years. The Corporation originally applied for a longer period; but Lord Morley cut it down to the time named. Another proposal they sought sanction for was to take steps to protect their drainage area from pollution. At present, many of the large towns who owned water-works had put in their Bills clauses which protected their drainage areas. Liverpool, Manchester, and Glasgow had all done this; and Leeds, not having the power, had applied to Parliament this session, and had a clause, similar to the one now proposed for Bradford, inserted in their Bill, notwithstanding the fact that it was opposed by the owner of the two farms on which sewage was treated. There was no opposition in the present instance; and this made Bradford's case all the stronger. Then, as the Committee knew, the time permitted by the Standing Orders for the repayment of loans and interest by means of sinking funds was now limited to sixty years. That was to say, the Corporation had to put away 1-60th of the loan every year. This meant, in the case of Bradford, no less than £22,000 a year, or equal to a rate of 5½d. in the pound. The Nidd works were costing the Corporation a very large sum. At present they had borrowed half a million sterling, which was entirely unprofitable; and they had another £800,000 to borrow. Necessarily, these loans were a great burden until they became remunerative. For this reason they asked to have the repayment of the loan by sinking fund suspended for ten years, or till 1901, when the works would be finished and begin to yield income. The result would be that for the fifty years remaining out of the sixty the ratepayers would have a little heavier burden. But they would be better able to bear the increase because by that time the water from the Nidd would be coming in and yielding revenue; for it had to be remembered that not only would the new works supply Bradford, but also large districts around. There were precedents in support of the application in the cases of Batley, Belfast, Birmingham, Bury, Edinburgh, Huddersfield, and other places, where the periods ranged from three to ten years. Leeds and Wakefield each had had ten years allowed them. The only other thing to which he need refer was the clause for preventing misuse, undue consumption, or contamination of water among domestic consumers. The Corporation wished to extend the prohibition to traders and others, of whom thousands were supplied by them.

Mr. *J. Watson*, M.Inst.C.E., the Water Engineer to the Corporation, was then called. He said he had designed the works now in process of construction. They were of very large capacity, and would carry water to Bradford from a distance of 40 miles. They were commenced early in 1893; and a portion was expected to be finished about 1901. The work was exceedingly difficult, as there was a tunnel 4 miles long; and there was no chance of its being constructed before the year named. The Corporation desired to get possession of their drainage area, in order to protect it, and render the water supply pure. Questioned as to the allocation of £22,000 a year to the sinking fund, of which the Corporation asked to be allowed to suspend the payment for ten years, he said they bore a serious burden, as they now had to pay interest on the capital they had borrowed, which at present yielded nothing. At the end of sixty years the works would be in as good, or even better, condition than they would be when first completed.

Mr. Boyce, of the Local Government Board, objected to the proposal; saying that the precedents cited were old, and those that were not old were not the precedents of the Committee. There was no town so favoured as Bradford, the Corporation of which were allowed for the liquidation of part of their loans the enormous period of 200 years—repayment to commence only after the expiration of 100 years. He also pointed out that the interest charges Bradford incurred on the money at present expended on the new water-works amounted to only £8000 a year.

Mr. Balfour Browne said Mr. Boyce appeared to suggest that the Corporation should be punished because they came before the Police and Sanitary Regulations Committee. He also seemed under a misapprehension as to Bradford's water undertaking. The works were an entirely new scheme.

In answer to the Committee, witness stated that the new works would not become remunerative until two or three years after their completion. Rates and taxes would be very heavy, as immediately the Corporation sent water through the mains the various local authorities through whose districts they passed would come in and assess the works for rates. By the year 1906—five years after the completion of the works—the Corporation would have a gross revenue of from £12,000 to £15,000 a year. The whole works would not become remunerative for possibly a

quarter of a century. By 1901 they would have spent on these works about £800,000.

The Committee decided to suspend the operation of the sinking fund until July 1, 1904; the sums already set aside being ordered to be kept separate, and to accumulate with interest, and be devoted to the purposes of the fund when it again came into operation. They also passed the clause extending by five years the time allowed for completing the works.

On the clause empowering the Corporation to test and stamp water-fittings, witness urged the necessity of the provision, as it was, he said, in the interests of the Corporation and the public that inferior fittings should not be used. They resulted in great waste of water and damage to property, especially as the pressure in some parts of Bradford was quite abnormal—amounting in the higher parts of the town to no less than 220 lbs. per square inch. Witness admitted, in reply to a question by a member of the Committee, that it was the intention of the Corporation to enter into competition with ordinary traders for the supply of fittings. The clause was sanctioned.

The Committee then proceeded to deal with the other portions of the Bill.

HOUSE OF COMMONS COMMITTEE.

Friday, July 16.

(*Before Sir* W. Coddington, *Chairman*, *Mr.* H. S. Samuel, *Mr.* Cubitt, *Mr.* Warner, *and Mr.* Allison.)

FYLDE WATER (TRANSFER) BILL.

The consideration of this Bill, which is to authorize the incorporation of a Joint Water Board, consisting of representatives from the Town Council of Blackpool and the Urban District Councils of Fleetwood, Lytham, St. Anne's-on-the-Sea, and Kirkham, and the transfer to the Board of the undertaking of the Fylde Water Company, was commenced to-day.

Mr. Pope, Q.C., Mr. Pembroke Stephens, Q.C., and Mr. Ram appeared for the promoters. The petitioners against the Bill were the Fylde and Garstang Rural District Councils, represented by Mr. Balfour Browne, Q.C., and Mr. Acworth; and the Fylde Water Company, by Mr. Pember, Q.C., Mr. Worsley Taylor, Q.C., and Mr. F. Mellor.

Mr. Pembroke Stephens, in opening the case, observed that the Bill was one for the purchase compulsorily of the undertaking of the Fylde Water Company. The Bill was promoted jointly by the four Corporations or public bodies representing the towns of Fleetwood, Blackpool, St. Anne's-on-the-Sea, and Lytham, which were towns on a part of the Lancashire coast which was every year resorted to more and more by the inhabitants of that county and of Yorkshire. Therefore, if there was a part of the country where pure water and an abundant supply, under conditions rendering it freely accessible, was desirable, surely it was in this case. Besides the towns he had mentioned, there were large outlying districts of an agricultural character which were affected. Since the incorporation of the Company in 1861, there had been eight or nine Acts of Parliament passed in their behalf; and one of the features of the concern was that whatever facilities or improvements in the mode of water supply had been obtained, had been so procured by way of settlement or arrangement. The source of the water supply was good and abundant in quantity; but it had been so handled by the Company as to make it a constant cause of dissatisfaction and complaint in the towns he had mentioned. As to the reasons for the transfer, he relied in the first place upon the incontrovertible argument in favour of placing water undertakings in the hands of public authorities; and if ever there was a case in which the advocacy of this principle was justified, it was especially so here. The principle of the Bill was this: It had been suggested that one authority ought to have bought the undertakings; and this clearly was one way out of the difficulty. But it would not be satisfactory to the districts concerned. It was proposed that the water supply should be in the hands of a Board of Control, to be constituted as follows: There would be seven representatives of Blackpool, three each of the District Council of Fleetwood and the Corporation of Lytham, and two of the District Council of St. Anne's. The learned Counsel dealt with the petitions against the Bill at considerable length, and said the petitioners desired the promoters to fix a date for the purchase of the undertaking. They were perfectly prepared to insert a date in the Bill; their wish being that the undertaking should pass into the hands of the authorities at the earliest possible moment. They also desired that the transfer should take place on fair and reasonable terms.

Alderman *Bickerstaff*, an ex-Mayor of Blackpool, said he was Chairman of the Joint Committees promoting the Bill, and the owner of considerable property in Blackpool and in the rural district outside the borough. He had ascertained that the total population of the areas of the Urban Councils promoting the Bill was 10,000 in 1861, and 63,385 in 1897; while the rateable value was £34,000 in 1861, and £424,000 in 1897. The four towns who were promoting the Bill represented 67 per cent. of the population of the water area, and 59 per cent. of the rateable value. There was a growing necessity for the water supply being in the hands of the Local Authorities. It would be an advantage that the ratepayers should have more direct control over the supply; and the consumers, through their representatives on the local bodies, would be able to direct the policy of the water authority. Witness gave particulars as to the population of Blackpool, as showing the necessity for a better and improved water supply, and said the Town Council were unanimously in favour of the purchase of the undertaking of the Company, and the four towns promoting the Bill were acting entirely in concert. As to the ratepayers, a poll was taken; and the vote in favour of the Bill was 5345, and against it 1140—being a majority of 4205 in favour.

Monday, July 19.

On the resumption of the inquiry this morning,

Alderman *Bickerstaff* gave particulars of the negotiations which had taken place with regard to the purchase.

Mr. *Heap*, the Chairman of the Finance Committee of the Blackpool Corporation, said that there was a strong feeling among the large majority of the ratepayers that the water-works should belong to them. So far back as 1891, the Council unanimously passed a resolution in favour of purchase. If the water supply were in the hands of the Local Authorities, they would ultimately be able to sell on more reasonable terms than a trading company could do. He thought, further, that on sanitary grounds the transfer should be made.

In cross-examination by Mr. Balfour Browne, witness denied that he had stated that the works of the Company could be purchased for between £400,000 and £500,000. He might have said that the Company asked £800,000, but that people always asked twice as much as they wanted. The Company circulated statements to the effect that the ratepayers would have to pay £1,000,000 for the works with the intention of frightening people. Witness was cross-examined at some length as to the finances of Blackpool; but he maintained that they were in a satisfactory condition, and that the Council could purchase the undertaking of the Company without any detriment to the public interest. In view of the fact that when the purchase took place they would have to put aside a sinking fund, he thought that for a year or two they would have to levy a rate of 2½d. in the pound or thereabouts. He had always said this; and he now repeated it very distinctly.

Cross-examined by Mr. Worsley Taylor as to the support of the several districts to the scheme, witness said he was at a ratepayers' meeting at St. Anne's, which was attended by between 100 and 150 persons, and it was not true to say that on this occasion the voting was eight for and eight against the resolution in favour of purchase. A considerable majority favoured the scheme.

Mr. *J. Crookall*, a member of the Fleetwood Urban District Council, said the resident population of the town and neighbourhood was estimated at 12,221; but he thought it was more. Besides this they had a large and increasing visiting population. The rateable value of the district was £54,915. The Council attached great importance to the question of an ample and satisfactory supply of water, and they had unanimously passed a resolution in favour of transferring the Company's works. At a ratepayers' meeting only one person objected to the resolution, and demanded a poll. This was accordingly taken; and the voting was 1448 for the transfer, and 68 against it.

Mr. *J. Slater*, a member of the Lytham Urban District Council, said that some time ago his Authority acquired the gas undertaking, and the transfer had been attended with great advantage to the district. He thought it would be an extremely good thing if the water supply also could be placed in the hands of the Local Authorities. The governing body of Lytham were equally in favour of the transfer, with the exception of the Chairman, who was a Director of the Fylde Water Company. On Dec. 21 last, a public meeting of the inhabitants was held at Lytham, at which a resolution in favour of the transfer was carried. A poll was afterwards taken, with the result that 596 voted for and 273 against the proposal.

In cross-examination by Mr. Worsley Taylor, witness said his opinion was that a Joint Board would do everything that would be best for the interests of the ratepayers.

Mr. *R. Hargreaves*, the Vice-Chairman of the St. Anne's-on-the-Sea Urban District Council, said St. Anne's was a rapidly developing health resort. The question of the water supply being in the hands of the Local Authorities had been before the Council, and not a single member had voted against the proposed transfer. A poll of the town was also taken, the result of which was a majority of 126 for the project.

Mr. *T. Fair*, J.P., a member of the Lancashire County Council and of the Health Committee, and also a Fellow of the Surveyors' Institution, said he had known the Fylde district all his life. He was the Agent for the Clifton Estate, and likewise for the Bourne Estate, with which he had been connected since 1864. As representing both rural and urban interests, he had considered the question of the proposed transfer of the water undertaking to the Local Authorities; and he had come to the conclusion that it was quite time the change should be made. The Water Company had been in receipt of their maximum dividends for some time; and there had been a surplus for several years. The property of the Company had been built up by the extraordinary growth of the watering-places within their area. He believed this growth would be more rapid still if the undertaking were transferred as proposed.

Cross-examined by Mr. Balfour Browne: He was aware that by the Bill the properties he represented derived an immediate benefit by the transfer, while in all the other cases the benefits were postponed for three years.

Tuesday, July 20.

On the resumption of the proceedings to-day,

Dr. *A. J. Anderson*, Medical Officer of Health of Blackpool, said he was well acquainted with the water supply of the Fylde. During the inquiry in the other House he went in great detail into the condition of the existing service, and produced a number of bottles of specimens of water actually taken from the pipes, showing that it was in no way different in 1897 from what it was in 1896, despite the fact that the Company came to Parliament and obtained capital and powers for its improvement. Indeed, the condition of the supply was worse now than it was when the Bill was before the House of Lords. As to the Fylde and Garstang opposition, he had made a survey of the district within the area of the Water Company. As the Medical Officer of Health, he considered it was very important that there should be a dependable supply of water. There were many parts of the district where the service was extremely defective; and he gave instances where the water was suspicious and dangerous—mentioning particularly the district of Marton, and the township of Hardhorn-with-Newton. In several cases, private proprietors of a water supply had made attempts to improve the state of things; but they had not always succeeded. He had been able to trace disease to defective water supply in the case of Marton, of which he had spoken. In the year 1895, there was a small epidemic of typhoid fever, which he found was due to the water supply of a farm.

Other witnesses having been examined in support of the Bill,

Mr. *G. H. Hill*, M.Inst.C.E., was called, and stated that he had advised the various Local Authorities acting in this matter. He thought this was one of the strongest cases he knew of where the control of the water supply should be in the hands of the sanitary authorities.

This closed the case for the promoters.

Mr. Balfour Browne then addressed the Committee on behalf of the

opposing Rural District Councils. He admitted that the case was a most important one, because if the Committee passed the Bill, he thought they would make a good precedent for handing over companies' works to the corporations of this country upon no rational grounds whatever. He hoped to be able to show that there was no precedent for such a case as this, where the Company had not been complained of, where there was no new scheme before the Committee, and where there was a substantial opposition by outside persons who did not want to be joined with the four Local Authorities. He had been connected with cases of compulsory purchase, but he had never known one like this. A local authority, unlike a company, would be bound to put aside a sinking fund, which would be raised out of the pockets of the people who consumed the water. The first case of the kind that came before Parliament was that of Stockton and Middlesbrough, in 1875. That was the first case of legal compulsion; and he thought it was justifiable, as the Company had refused to furnish a proper supply. But there was no such allegation in the present case; and from 1875 downwards no precedent could be found for a Bill like the one before the Committee. Here there was no such general principle as would justify the transfer of the works of the Company to the Local Authorities. If the Company had failed to do their duty, they ought to go. But they had not failed; and a large portion of the district supplied protested against the proposed transfer. There was not only no precedent for it, but it would be against common sense to carry it out.

Mr. *W. J. Fitzherbert-Brockholes* said he was an Alderman of the Lancashire County Council. His estate was partly in Garstang and partly in the Fylde; and he would be adverse to seeing the water-works handed over to one large authority, with minor authorities at its mercy. He thought, if the transfer were allowed, Blackpool would practically dominate the management of the water.

Mr. *G. Breakall* and Mr. *J. Noble*, of Garstang, gave similar evidence.

Wednesday, July 21.

To-day the case for the opponents of the Bill was continued.

Mr. *T. Finch* said he resided in the Fylde rural district, and was a member of the Fylde District Council and the Board of Guardians. He was a member of the Joint Committee which in the first instance considered the propriety of securing the water-works. Up to a certain point, they were agreed with the authorities; but eventually, when they understood that the purchase could not be made except under financial circumstances which were beyond their reach, they retired from the position, and abandoned the idea of taking a share in the project, as this meant the levying of a rate which the rural district could not bear. He had considered the question whether the rural district would be better provided for by the Company than by the promoters. His Council had consulted various well-known authorities, and they had come to the conclusion that the terms of the Company were preferable to those offered in the Bill. A great proportion of the farms would get, under the Company's scale of charges, an advantage of 20 per cent. His principal reason for opposing the Bill was that he considered the Company's terms better than those of the proposed Joint Board.

In cross-examination by Mr. Pembroke Stephens, witness said that, having carefully considered the scale of charges of the Company and the Joint Board, the fact was that 40-acre farms and upwards were all more favourably treated under the Board's scale than under the Company's, with the single exception of troughs. The question of troughs was not the one which had changed the mind of the Board. He was present at a meeting of the Garstang, Kirkham, and other Local Authorities, when a resolution was passed that it was advisable that the undertaking of the Company should be possessed by a Joint Board composed of representatives of all the sanitary authorities in the area of supply. He did not vote for it, nor did he vote against it.

By Mr. Balfour Browne: Looking at the scales as a whole, the Company's offer was better for the consumers than that of the Board.

The Chairman (to witness): The Company seem to have made the concession, in May last year, of reducing the charge for the extension of the mains from 8 to 5 per cent., and also made a material reduction in the charges for water, varying from 25 to 30 per cent. Do you think the Company would have made these reductions if the Local Authorities had not gone in for this Bill?

Witness: I cannot say; though I know from hearsay that the Company, and especially the Chairman, had taken an altogether different view of this question from that which they held some years ago.

The Chairman: The Committee would like to know from the promoters if there is a farm in the whole district which would come under the definition of an "arable farm."

Mr. *Fair* was re-called to speak on this matter. He said there were only a few of such farms in the Fylde Union; and the scale dealing with arable land would come into effect in very few instances. It was not fair to class arable with mixed or dairy land.

Mr. *G. Singleton*, J.P., said he was thoroughly against the transfer, as he thought the rural districts would be far better off under the Company than under the proposed Board; and this was the view of his neighbours and tenants. He was of opinion that the terms offered by the Company were more favourable to the consumer than those offered. He did not know a single purely arable farm in the district. The water supply was excellent in quality and unlimited in quantity.

Mr. *C. E. D. H. Atkinson* said he owned a large quantity of land within the area of the Company. He had been supplied with water by them for many years, and he had every reason to be quite satisfied, both as to quantity and quality, and also with his dealings with them generally. So far as he knew, they had done their work well for the rural districts. He quite agreed that there should be an extension of the supply into the rural districts; and he thought this could best be done by the Company, because they best understood the matter.

Archdeacon *Clarke* testified to the excellence of the Company's water, and said he thought it would be best for the district if the supply remained in the present hands.

Mr. *J. W. Fair*, J.P., said he had been repeatedly brought into relationship with the Company, and had always found them reasonable. Looking at the question from the point of view of local agricultural interests, he thought it would not be for the benefit of his district that the water-works should be transferred from the Company to the Local Authorities. The country districts would never get adequate representation on the Joint Board, which would be dominated by Blackpool; and the greatest distrust existed as to the results of the transfer. The feeling of the rural districts was unanimously against the change.

Mr. *C. Hawksley*, M.Inst.C.E., said he had inspected the works of the Company, and found them in good condition, and capable of supplying the whole of the district, especially with the additional main-pipe which was to be put down when the works authorized last year were completed. He could see no advantage that would accrue to the consumers of water in the rural district from the proposed change. He did not know a single case where, under similar circumstances, a transfer of water-works had been granted. He thought the rural districts would be better served by a well-directed company than by a corporation.

Other witnesses having given evidence,

Mr. *A. Simpson*, the Chairman of the Company, gave a history of the undertaking, which was started in 1860 by certain gentlemen interested in the district. They paid no dividend until 1865; up to 1870, they paid 3 and 4 per cent.; from 1870 to 1891, the dividends varied from 4½ to 8½ per cent.; and since 1891, the Company had paid their maximum. The average rate was a fraction over 6 per cent. Most of the Directors were local men. The cost of management per annum had been reduced from 52 to 28 per cent. This compared favourably with a great many companies. Judged by results, the concern was most efficiently and economically managed. The average interest payable upon all the authorized capital worked out at about 4·6 per cent. As their loans were now reissued and fell in, they raised money at 2¾ per cent. When they found it necessary to increase their works, they bought up land privately, and in this way saved a large sum of money in the way of capital expenditure. As regarded the supply, the regularity had been such that never since 1877 had it been necessary to cut off the water. He had no reason to suppose that the Blackpool Corporation could borrow money more cheaply than the Company could. Seeing that the Joint Board would have to pay for the undertaking according to its value, there would not be much gained by the community.

Mr. Pember then addressed the Committee on behalf of the Company, and urged that their conduct had been good. In justice to the rural authorities, he appealed to the Committee to reject the Bill, which would substitute for an authority that was at all events impartial, a Joint Board which there was every reason for believing would not work well.

Mr. Pope, replying for the promoters, said he was content to rely upon the enunciation of the principle upon which Parliament had acted in these cases made by Mr. Worsley Taylor, who had said that the principle of Parliament was fairly expressed in the words which had been employed by the late Royal Commission; and subsequent Committees had time after time come to the conclusion that it was to the advantage of the whole community that a water undertaking should be in the hands of the local authority, whenever it could be justly transferred. Of course, having regard to the circumstances of the Company and to the general effect of the transfer upon the interests of the shareholders, the promoters proposed to act in a spirit which would prevent any wrong being done; and he could not conceive any injustice to a body of shareholders if they were able to realize the full value of their undertaking, together with such an amount as an arbitrator might think fit to give them, by reason of the sale being compulsory.

After a few minutes' deliberation,

The Chairman announced that the Committee considered the preamble of the Bill proved, but that they had certain suggestions to make with respect to clauses.

These were notified, and the Committee adjourned.

Thursday, July 22.

On the re-assembling of the Committee this morning,

Mr. Pope said he would explain the clauses the promoters proposed to bring up to give effect to the decision of the Committee. The rural authorities had sent word that they preferred not to become partners; therefore the clauses which he brought forward were in respect of two or three matters which the Committee had intimated were involved in their decision. They seemed to have felt that there was something in the fear of the rural districts that they might be overborne by the superior authority of the urban bodies. This, of course, would not have arisen if the rural authorities had desired to be joint bodies with the urban. It occurred to him that the best way of dealing with this matter was that which he would propose. In the Bill there was a provision that, in the event of any of the constituent authorities having reason to complain of the other authorities, the Local Government Board should have power to intervene. He proposed now, in order to put the rural districts at their ease as regards any coercion or ill-treatment on the part of the authorities, or unfair charges, to insert this clause: "Any District Council or person complaining of unfair treatment by the Board in regard to the supply of water on the part of the constituent authorities, or in regard to the supply of water beyond the districts of the constituent authorities or in regard to the charges therefor, shall be at liberty to appeal to the Local Government Board that that Board may make such inquiry into the matter as to the Local Government Board may seem fair and equitable, and that this shall be binding." This seemed to him to meet the difficulty. Then the Committee desired some better definition of "arable farm" in the schedule. He was prepared to add as a rider: "That, for the purpose of this schedule, the expression 'arable farm' shall mean farms which are wholly under the plough, save as to such area of permanent grass land as may be necessary for the keep of cows for giving a supply of milk for the use of the tenants or occupiers' family or resident servants only;" so that if the tenant became a dairy farmer, and obtained profit from the sale of milk, he would not be considered an arable farmer. As regarded troughs, the new scale would be: One trough free; and if they wanted any more they would have to pay 10s. each. They proposed to amend section 2 of the schedule to the effect that the Board might require at least one trough to be provided; or, if not, then the charge to be paid which would be payable in respect thereof if the same were provided for more than 20 acres.

Mr. Balfour Browne said the rights of the rural districts were still unprotected. They objected to troughs at 10s. each, and in regard to the definition of "arable land," he proposed that there should be inserted the words "if no more than one-fifth of the total area of the land held

therewith is meadow or pasture land." He objected to the matter being fixed by the number of cows that were kept.

The CHAIRMAN said the Committee approved of Mr. Balfour Browne's amendment, but suggested one-eighth instead of one-fifth of the total area of the land.

Mr. POPE remarked that in arable farms there must be a certain quantity of pasture land for domestic purposes. He was content if the Committee thought that one-eighth fairly represented such a provision.

The CHAIRMAN said the Committee decided that one-eighth of the land must be under grass, or it would not be regarded as an arable farm. He added, with regard to troughs, and the question of having a second one supplied, that this should be withdrawn, and that instead, where a pond was supplied for domestic purposes, the charge for extra troughs should not exceed 10s. The Committee further decided that the limit of 20 acres should be extended to 40.

Mr. WORSLEY TAYLOR applied for the costs of the Company in opposing the Bill.

Mr. POPE objected.

The CHAIRMAN said the Committee had decided to follow the precedent of similar cases, and refuse costs.

Various clauses were then adjusted in accordance with the Committee's decision, and the Bill was ordered to be reported.

LEGAL INTELLIGENCE.

Charge of Embezzlement against an Official.

At Sandbach (Cheshire), last Wednesday, Elisha Lees was summoned on a charge of unlawfully appropriating to his own use £1750 while holding the position of trustee of the money. He did not appear, and a warrant for his arrest was granted. Lees has held many responsible positions at Sandbach; having been Surveyor to the Local Board, Secretary to the Gas Company, and Collector of Government taxes.

Theft of Gas and Water Fittings.

At the County of London Sessions, last Wednesday, before Mr. W. R. M'Connell, Q.C., George Carter, 28, a carman, pleaded "Guilty" to stealing certain fittings, value 10s., from an empty house. Mr. Travers Humphreys, for the prosecution, stated that in broad daylight on July 20 the prisoner gained an entrance to 51, Lower Park Road, Peckham, through the kitchen window, and wrenched off the water and gas fittings, causing the water and gas to escape. The smell of gas attracted a neighbour's attention, and the police were communicated with; and the prisoner was caught red-handed. A previous conviction was proved; and he was sentenced to twelve months' imprisonment—well-deserved punishment, seeing that the gas-meter was taken down, and the gas left escaping from a ¾-inch service-pipe.

An Exemplary Fine for Misusing Water.

At the Barry Dock Police Court, a few days since, Frederick J. Griffiths was summoned, under the District Council's Water Act, for unlawfully using water for other than domestic purposes when not entitled to do so; and also for stealing a quantity of water. A police constable stated that he visited defendant's premises early on the morning of July 13, and saw an iron pipe about 2 inches in diameter connected with the house tap and conveying water near the stable for use at that place. A water inspector in the employ of the Council deposed that he saw a hose going from the house towards the stable in October last year; and on July 10 the same witness went to the premises and found an iron pipe as already described. Mr. E. W. Waite, the Water Engineer, gave evidence that the Council were empowered to make a charge of 1s. 6d. for each horse kept; and 2s. 6d. for a hose. The Bench decided to take a serious view of the matter, as they had every reason to believe that the practice of using water for other than domestic purposes had gone on for some time. In the first case they imposed a penalty of £2; and in the other one of £3, in addition to costs.

Reductions in Price.—The Chester Gas Company have reduced the price of gas by 3d., to 2s. 11d., subject to cash discounts from 1d. to 5d. per 1000 cubic feet, as from the 1st ult. The Gravesend Gas Company have reduced their price by 2d. per 1000 cubic feet; bringing it down to 3s. 1d.

Reduction in the Price of Gas for Public Lighting at Truro.—An interesting and pleasing communication was read at the meeting of the Truro Town Council last Tuesday. As already announced in the "JOURNAL," the Directors of the Gas Company recently decided to reduce the price of gas in Truro by 2d. per 1000 cubic feet as from the 1st of July. Mr. S. J. Ingram, the Company's Manager, now wrote that they had decided that the Corporation should have the benefit of the reduction, notwithstanding the existence of a contract for public lighting of which 15 months are unexpired. Mr. Ingram, whose letter was addressed to the Town Clerk, said: "As you are aware, in September, 1895, your Council entered into a contract with this Company for the public lighting of the city for a period of three years on definite terms; and as a portion of this time is still unexpired, it does not appear that your Council is entitled to any reduction that may be made in the meantime on account of gas used for purposes of public lighting. However, my Directors have considered this matter; and I am instructed to inform you that they will give the Council the full benefit of the reduction at once, without waiting for the expiration of the contract. The reductions will be as follow: Midnight lamps, 10d. per lamp; all-night lamps, 2s. 6d.; duplex burners, 3s.: triple burners, 4s. Perhaps you will be good enough to inform your Council of this matter at their next meeting, and express the hope of the Directors that the concessions may lead to the extended use of gas for public lighting purposes in the city." The Mayor (Mr. T. L. Dorrington) remarked that they ought to be much obliged to the Gas Company for the very liberal way in which they had met the Council.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held at the Bridge House Hotel, London Bridge, S.E., last Wednesday—Mr. GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Frank Bush) read the notice convening the meeting, and the minutes of the last half-yearly and extraordinary general meetings; and in affixing the seal to the register of shareholders, the Chairman announced that they now numbered nearly 7000. The report of the Directors, with the accounts for the six months ending June 30, given in the "JOURNAL" for the 3rd inst., was taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, after observing that it was pleasant to see so large a meeting at this time of year, remarked that the most important paragraph in the report was the second—not, perhaps, as immediately affecting the shareholders, because whatever the rating might be, the charge for it was transferred to the consumers—in the case of their Company entirely, because they were not paying the full dividend. If, however, they were, the proportion borne by the consumers would be six-sevenths of the whole. As the shareholders might know, they had had some trouble with the rating authorities, particularly in the outlying parishes. In the central parishes, they had been met fairly, as stated in the report. Every five years the Company's property was re-assessed; and if the quinquennial year happened to be a bad one—a year in which the profits were deficient, as they were in 1889—strictly speaking the rateable value ought to be reduced in proportion. But in 1889 or 1890, when they were dealing with the 1889 figures, the parishes urged that the profits of the year 1889 could not be taken as giving a fair average for the following five years. The Company's representatives admitted the fairness of this proposition, and agreed to a compromise—that was, to a rateable value higher than the figures of 1889 would have sustained. The next time—in 1895—when they were dealing with the figures of 1894, which happened to be the most profitable year the Company had ever had, they urged the same thing on the Assessment Committees. The more important parishes—all the central parishes, all the large and thickly inhabited parishes—admitted the force of the contention, and rated the Company, as the Directors considered, fairly; but the outlying parishes would not listen to reason in this way. They insisted on their "pound of flesh," and said they were entitled to rate the Company on the profits of the quinquennial year of 1894. It was rather an extraordinary divergence between these parishes; but he thought it was to be accounted for in this way: The professional advisers of the central parishes were, most of them, old-established men; and he believed that when they were asked (he knew this was the case in eight out of the ten parishes, and he believed the same might be said of the other two) at what rate per cent. they would agree to assess the public companies in the parishes, their reply was: "We will not agree to any rate per cent. at all; it is not the proper way. We will name a fee for the rating, and whatever the result may be we are to receive the agreed fee." In these cases, they had no special interest in putting up the rate. In the others, they had investigated the parish books, and found that the gentlemen were to be paid a commission of 15s per cent. on the sustained amount of the assessment—giving them a direct interest in making it as high as possible. It might be said: "Why not? An auctioneer called upon to sell a property is paid a commission." This was quite true; and it was quite proper. The auctioneer's interest and his duty also was to get as much as he could for his client in selling the property; and it was perfectly fair to give him a commission on the amount he realized. Then, it might be said, engineers and architects were also paid a commission on the amount spent on the works they designed or carried out. Their case was not identical with that of the auctioneer. It was to the interest of their clients that the effect should be obtained with as small an expenditure as possible; and to give them a commission on the amount spent was a bad system, though nothing better had yet been devised. There was, however, this safeguard with respect to engineers and architects: An expensive engineer or architect became known, and soon lost his business. Being members of an honourable profession also, there was a feeling of *esprit de corps* among them which induced them to do the best they could for their clients. When, however, they came to the rating question, these influences did not work. The rating surveyor thought it was his interest and that of his clients to get as high an assessment as possible. None of the Assessment Committees understood the system of rating public companies. They wanted impartial and honest advice; but when they paid a commission on the amount of the assessment sustained, they were not going the right way to obtain it. There was the fact that the parishes advised by assessors who acted in the old-fashioned and proper way, rated the Company fairly; whereas the parishes advised by assessors whose interest it was to make the rating as high as possible treated them in a way which they considered unfair. They had been to the sessions; and the result was that, while there was a considerable reduction on the large estimates of these gentlemen, yet the figures were still considered too high. The Directors were not satisfied; and, as was very frequently the case when one went to law, one of the commonest things was to appeal to a higher Court. They could not, however, do so in this case, but they could appeal to the Court on a different set of figures. The Court had before them in 1895 the figures of 1894 and June, 1895—the most profitable period the Company ever had; and the Court said: "These are the only figures on which we can adjudicate." The figures of the last twelve months were very different indeed. There was a greatly reduced profit. In fact, whereas in 1894 they realized a large surplus profit, which went to make up the losses of some previous years, and enabled the price to be reduced, in the past twelve months their profits had not been sufficient to pay their dividend, and they had to draw upon their reserves. On these figures they proposed to appeal. He thought the Assessment Committees (he had been before one of them, and there were three or four others they had to see) were disposed to meet them

fairly; and if so, all would be well. They had, however, as a matter of precaution, given notice of an increase in the price of gas in those parishes where the assessments were excessive. As he had said, they were not earning their dividend, and they wanted something more. They did not want 1d. per 1000 cubic feet on the whole of their gas supply; and being more than they wanted, they would not be justified in taking it. But they did want something; and to act fairly to the properly rated parishes, the Directors had given notice that in the highly-rated parishes the price of gas would be raised by 1d. per 1000 cubic feet. This would not come into effect until they issued the September accounts; and they were in hopes that the Assessment Committees would deal with the matter in a fair spirit. If so, there would be no necessity to carry out the increase in price. He could assure the proprietors that it went very much against the grain for the Directors of the South Metropolitan Gas Company to raise the price at all. It had been said that this threatened increase, or notice of increase, had been made in a vindictive spirit. But he could assure the shareholders that there was no foundation for such a statement. The decision was not come to hastily. The idea first occurred to him about four months ago; and it was discussed and debated by the Board for three months. They were all very loth to do it; but they saw no other course open to them. In order to provide for an anticipated deficiency (which he was happy to say had turned out to be not nearly so great as they had expected), there was nothing for it but to give notice of an increase in price. They could not reduce their dividend. They were only paying 5¼ per cent., and were entitled to distribute about £14,000 more among the shareholders. Not having earned it, however, they could not pay it; and if they had earned it, the Directors would have recommended the shareholders to add it to the reserve fund instead of using it as dividend. He had said that their dividend was 5¼ per cent.; but it really only amounted to 3¾ per cent. During the early part of the year, the Company issued £56,000 of new stock. The Directors offered this to the consumers at the market price, as by law required. The £56,000 was applied for many times over; and they could not give the consumers anything like what was asked for. They limited the amount to £100; and they distributed the whole £56,000 among the consumers, none of whom received more than £100—the Directors' idea being that the broader based their Company was among their consumers, the more stable and secure they would be. It would be better for the Company to have 100 consumers each holding £100 of stock, then one wealthy gentleman in the City holding £10,000, who had no interest whatever in the district supplied by the Company. These shareholders were only getting a return of 3¾ per cent. on their investment; and the Directors did not feel that they would be justified in reducing the dividend to any extent whatever, because they were pledged to these people. The Directors told them they would get 3¾ per cent.; and they saw their way to do it. They intended to maintain this, and hoped at no distant time to increase it. It might be asked, as to the question of the rating of gas companies, why they made all this fuss about it. It did not affect the shareholders. They could transfer it all to the public—the consumers. But the shareholders and the consumers were partners. Under the sliding-scale, the consumers were the sleeping partners in the Company; and the Directors felt it was a duty they owed to them (and it moreover made their own position more secure) to sell gas as cheaply as possible. Gas was rated at a higher proportion than almost any other article. Taking their last assessment, he found that the rates paid by the Company on the figures would be about 20 per cent. of the profits divided by the Company; whereas he found that in other trades some of the rates amounted to only about 3 per cent. of the profits and in others to 5, 7, and 8 per cent., while in one instance he found they amounted to 10 per cent. on the profits of the business—the average not exceeding 7 per cent. Therefore gas consumers paid about three times as much in the shape of rates on their gas as they paid on any other article. On this ground, the Directors felt they were only doing their duty in trying to have this matter put on a proper and a fair footing. There was one thing they had been most anxious to make clear—viz., that the consumers paid the rates. He had told this to the Assessment Committees time after time; but they had evidently not believed it. It was, however, the fact. The report showed an increase of 10 per cent. in the quantity of gas sold. This was going back to the old days. Ten years ago they used to have an increase of 3 or 4 per cent. But 25 years ago they had increases of 10 per cent.; and now they had obtained this large increase again. It was partly due to their ordinary consumers burning more gas; partly to its extended use for manufacturing, cooking, and heating purposes; and it was also considerably owing to the use of gas by the working classes. Last week, in the course of an article dealing with the danger of mineral oil, the "Star" urged upon gas companies to do what they could to supply gas to the working people; and reference was made particularly to this Company. He might say that they had now about 63,000 working-class consumers. When he told the proprietors that the total number possible was perhaps about 100,000, and that they now had two-thirds of this number, and were laying on these supplies at the rate of 200 a week, he thought it might be said they were doing what they could in this matter. They had offered an inducement to all their employees to become canvassers, and every one of them who brought in a new consumer received a small *douceur*. The great Company on the north side of the Thames had passed them now; but their district was so much larger than the South Metropolitan Company's. The other Company had 65,000 of these consumers. He must say that the "Star" acted fairly towards them; and he had mentioned these particulars in response to what was said last week by that paper. They were continuing to do what they could to promote the use of gas and to discourage the use of mineral oil, which was destructive to life in many cases. The other part of the paragraph he had been referring to alluded to coke, tar, and ammonia. Had the Company received the same price for these articles as they obtained in the early part of 1894 (which was an exceedingly good year, and the prices then realized were certainly high), they would have been selling gas at 2s. per 1000 cubic feet—in fact, they could have sold it at less than that, because the loss on the products amounted to rather more than 4d. per 1000 feet He thought it was satisfactory for their Company to feel that, though the loss on products had been so great in the past three years, the Company were now selling gas at an average of 1½d. per 1000 cubic feet lower. The average price in the June half of 1894 was 2s. 4½d., whereas the Company were now charging 2s. 3d., or 1½d. lower, though the reduced value of products had taken 4d. per 1000 cubic feet from them. With regard to the question of coke, he might say that, so far as their Company was concerned, they did not sell any out of their own district. If anyone came to them for a barge load of coke, they sold it without question; but they did not send it all over the country. As to contract coke, they sold it by direct negotiation with the cement makers. They did not ask for tenders, for it was of no use to do so if there were no competitors. If they invited tenders for their coke, the cement makers, who acted together, would send in a single tender in one envelope. The merchants who bought coke also agreed together. They would all tender at the same price; and the figure would be less than they were ready to accept. Tenders had been asked for in other cases in the last two years; and there were no competitors. At any rate, they themselves had found it better to sell their coke by direct negotiation. Ammonia was very bad, and tar was equally so; but, notwithstanding this, they saw their way, if they were met in a proper manner about the rates, to pull through at the 2s. 3d. price, and continue to pay the same dividend. The working, he might say, was in all parts more satisfactory than he had ever previously known it. He would take one item—carbonizing wages. After the great increase that took place in 1889, these rose from 2s. 7½d. to 3s. 6d. per ton of coal. They had now got them down to 2s. 3d.; so that they were lower than they were before the great increase of wages in 1889. This had been brought about partly by the use of machinery. During the past six or seven years, they had been extending the use of machinery in their various retort-houses. It was just the work that ought to be done by machinery. It was hot and heavy for men; and by the use of machines they had been able to bring down the cost of carbonizing in the machine houses to about 1s. 8d. per ton. It would be about 1s. 6d.; but they added 2d. for the maintenance and repair of the machines. This brought it up to 1s. 8d., or about half what it was after the great rise. In the work that was done by hand, their men worked in a very satisfactory manner; and they found that their carbonizing wages were about 2s. 9d. a ton. He attributed this to the fact that their men were willing to do an honest day's work, both by hand and machine. Instead of limiting the work done by the machines, the workmen endeavoured to do as much as possible; and the Company had felt it necessary to stop them and say: "You have done quite as much work as we consider fair and proper, and you must not try to do more." This was rather an extraordinary statement to make; but why was it? Because these men were free from the Trade Unions. The workmen were all right, but the Trade Unions had a very adverse effect on them. The Trade Unions—he said it deliberately—were encouraging workmen to be dishonest; that was, to give less and less work for the wages they received. They were not only tyrannical organizations, but they were encouraging dishonesty—he spoke of the great majority of them. They might seem to be very powerful just now; but if one might venture to prophesy, he would say that a power could not last based on tyranny and dishonesty. The Company had been the first to adapt their circumstances to the new Workmen's Compensation Act. Their contention had been, with Mr. Chamberlain, that it was right that an industry should provide for its killed and wounded. If an accident destroyed their machinery, they must restore it; and it did seem unfair and unreasonable that if the workman who worked the machines was injured by accident in the course of his employment, he was to be cast aside to the workhouse or ruined. The best plan was to fully provide for him by means of a mutual fund. Therefore on the passing of the Bill—in fact, before it was passed—they had a number of meetings with their workpeople, and agreed on a scheme whereby, by a mutual payment, compensation was provided for all accidents on terms better than could be obtained under the Act. The men paid 2d. a month, and the Company 4d. per man. There was no compulsion about the matter; the men had been free to adopt it or not. They issued a notice to them, and out of 3000, more or less, regular workmen, all accepted it but one. He was himself rather thankful for that one, because it showed that if one could be independent any number could be. But all accepted it except one. This was very satisfactory, as showing the good sense of the workmen and the good feeling and confidence in what their employers were trying to do. The Company's works were in good condition. He felt that, though products were so bad, they could see their way to go on; and if they improved only slightly, it would be all to the good. He never stood before them, he thought, when he had the feeling stronger than on the present occasion that he was dealing with a most satisfactory report. He could not promise any reduction in price or increase of dividend; but he might tell the proprietors that the working was being conducted by a thoroughly devoted set of officers and men. He did not say that all their men were devoted to the Company, because some were not; but a large proportion were, and were honestly doing a fair day's work for a fair day's pay. With these elements of prosperity, he thought they need have no fear that the prosperity of the undertaking would be maintained.

Mr. Simpson Rostron seconded the motion, which was carried unanimously.

The Deputy-Chairman (Captain T. B. Heathorn, R.A.) then proposed—"That a dividend at the rate of 5¼ per cent. per annum be now declared, and the warrants be transmitted to the registered addresses of the proprietors by post."

Mr. J. Mews, in seconding the motion, stated that, with regard to the question of rating, which had been raised by the Chairman, the chief difficulty arose from the supineness of Parliament, because the Act under which they were all working with respect to the rating was passed in the year 1601. In those days, as they were all aware, there were no canals, no railways, no gas undertakings, no water companies—in fact, no trading corporations of any kind. There ought to be some automatic system by which they could be rated.

The motion was carried unanimously.

Mr. Hogarth then proposed a vote of thanks to the Chairman and Directors.

Mr. Foster seconded the motion, and expressed his pleasure at the remarks of the Chairman with regard to Trade Unions. He thought that, if the working classes did not mind what they were about, they would before long see a very large number of foreigners imported to do their work.

The Chairman: Or the work will be done abroad, and be imported.

The motion was carried unanimously.

The CHAIRMAN said he had rather hoped that they would have heard something about the rating question from his friend, Mr. Jones. He desired to thank the proprietors sincerely, on behalf of his colleagues and himself, for their kind vote, which had been dealt with in such a manner by them as to show that they had meant what they had said. It was therefore, a great encouragement to the Directors, who, he was quite certain, were proud of their connection with the Company, and anxious to do the best they could for all parties interested in it—shareholders, consumers, and employees. They were a co-partnership; and the Directors had to consider all parties, and to do justice, as far as they were able, to all. He could not sit down without asking the meeting to pass a vote of thanks to their officers, staff, and workmen. They were on a different system to what was generally in vogue; and this being so, he thought it was only right that the shareholders should, in meeting assembled, express their thanks for the good work done in the past half year by the engineering staff, of which Mr. Frank Livesey was the head, and by the clerical staff, of which Mr. Frank Bush was the head. In this he included the whole of the staff—not merely the officers and foremen, but the workpeople and employees of various grades. He could say nothing about his brother, except that he was thoroughly devoted to the Company. The same remark applied to Mr. Bush; and they had a staff of officers who were really proud of being connected with the undertaking.

Mr. H. E. JONES, in seconding the motion, spoke warmly of the qualifications of Mr. Frank Livesey; and remarked that Mr. Bush was also well known to them all. It was under Mr. George Livesey that the splendid results submitted to them that day had been achieved; and he believed that that gentleman's guiding hand was precisely that under which most of the officers would have preferred to campaign. The Chairman had made a sort of challenge to him on the question of rating. Gas companies and water companies especially, and a few other companies, were rated not like everyone else, on their occupation of land, premises, or real estate, but upon their profits; and he thought that the custom of so rating was a pernicious one, which Parliament ought to put an end to. If the Royal Commission did not give the relief they were entitled to, he trusted that their Chairman, to whom he could promise the assistance of another Metropolitan Gas Company, would promote a Bill in Parliament to ensure that they should be properly rated. This matter and the extra candle power which was now incumbent to be given by the Gas Companies, but which was of no use to anybody, might be carried in a little "omnibus" Bill. This would cheapen the price of gas. The present system handicapped their business; and they ought not to be handicapped.

The motion was carried unanimously.

The CHIEF ENGINEER (Mr. Frank Livesey) cordially acknowledged the vote, and assured the proprietors that the work of the Company was going on well. If it were not for the low prices they were receiving for residuals, the working statement would show up very well, owing to the large measure of what he might call harmonious rivalry of the Engineers operating with willing workmen. They were reconstructing their works. Some of them had been finished and others were in course of reconstruction; and when they were completed, he hoped they would be able to show such results, in spite of residuals, that the profit-sharers would benefit. He also hoped that the results would be satisfactory to the shareholders; and he was sure they would be to the consumers.

The SECRETARY also briefly acknowledged the vote of thanks; and the proceedings terminated.

BRENTFORD GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Friday, at the Charing Cross Hotel—Mr. HOWARD C. WARD presiding.

The SECRETARY (Mr. W. Croxford) read the notice convening the meeting; and the report and accounts, which were summarized last week were taken as read.

The CHAIRMAN said before he entered into an account of the transactions of the past half year, he had to report, with great regret—indeed, with more than regret—the loss of one of their number on the directorate. He referred to Mr. John Orwell Phillips, who had occupied a seat at his right hand for many years. Mr. Phillips was no ordinary man. He was one of the giants of gas administration in the Metropolis, and, he might say, in England. Even before he became a Director of the Company, the Board had the benefit of his advice and assistance at all times; and it was with real sorrow that they lamented his loss. In filling the vacancy, the Directors had considered it their duty to look out for a gentleman who would be likely to benefit the Company by his knowledge of their business and by his talents generally. It so happened that their respected friend, Mr. Frank Morris, who had been in the service of the Company for more than thirty years, had intimated his desire to retire; and the Directors therefore invited him to send in his resignation, in order that they might elect him to the vacant seat. Mr. Morris knew the whole of the Company's district and business as well as it was possible for anyone to do—indeed, he had been a distinguished member of his profession, as being the pioneer in this country of a new method of making gas. He (the Chairman) was sure that Mr. Morris having a seat at the Board, and joining the other Directors in caring for the interests of the Company, would prove of great service in the future. As a proof that he was not making these assertions in a hap-hazard way, he would like to refer to the change they had made from horizontal to inclined retorts. The first man who did anything of the kind in England was Mr. Morris; and he had since been gradually improving the use of the system, with the result that it had been of great advantage—certainly to their Company, and to everyone who had used the retorts with anything like discretion and skill. In order to justify this statement, he had a return for twelve half years of the manufacturing wages paid by the Company and the quantity of coal carbonized. It would be sufficient, however, if he only went back to June, 1894. In that half year, the wages for carbonizing averaged 3s. 6d. per ton of coal; while in the past six months, they were equal to 1s. 11d. per ton. The amount of coal carbonized in the June half of 1894, was 59,639 tons; and in the past half year it was 74,616 tons. The total wages paid in June, 1894, in respect of carbonizing was £10,428; while the amount for the past six months, with an increased quantity of coal, was £7252. This reduction had been effected through the talents of Mr. Morris, and the activity of their new Engineer (Mr. J. Husband). The carbonizing wages had actually been brought down from 3s. 6d. to 1s. 11d. per ton, which was a saving of 1s. 7d. As he had said, they carbonized last half year 74,600 tons of coal, which was, roundly speaking, 150,000 tons a year; and, multiplying this by 1s. 7d., showed a saving for a year of nearly £12,000. This was surely sufficient to recommend the system to anyone; and it spoke greatly for the skill of Mr. Morris. It had been said, and there had been a great controversy on the point, that with this system the wear and tear was enormous; and therefore he would like to tell the shareholders something about this item. In the half year ending June, 1892, when they began the use of inclined retorts, the total wear and tear under the heading of manufacture of gas (carbonizing 60,000 tons of coal) was £11,233; while in the half year ending June last (carbonizing 74,600 tons), the item amounted to £9030, including £1700 which the Directors had written off for rehabilitating a gasholder and for the conversion of horizontal into inclined retorts. They had now written off the whole of the cost of changing from the horizontal to the inclined system; and this ought to be a satisfactory proof that they had been proceeding, under Mr. Morris's direction, in the right course. So far as the working of the half year was concerned, they had, like other gas companies, been suffering from the great depression in the value of residuals; and the Directors ventured to express the hope that they had come to the bottom of the depression, and that in the future they would show better results in this respect. As to the consumption of gas in the half year, it had been perfectly marvellous. They had had an increase of nearly 10 per cent. in the quantity of gas consumed; the gas-rental amounting to 9·81 per cent. over the corresponding period of last year, and 12·8 per cent. over that of the first half of 1895. And yet they had had no frost, fog, or severe weather. This showed the great increase there had been in the use of gas as fuel; and Mr. Husband told him that in the last few weeks the increase had been going on at the rate of 15 per cent. Of course, one of the great reasons for the increase was the extension of the automatic meter business, which continued to increase in a remarkable manner. The number of meters on hire at June 30 last was 9567, as against 6675 at the corresponding date in 1896, which was an increase of nearly 43 per cent. As to the works, the reconstruction of No. 2 gasholder at the Brentford station had been completed; and it was now in constant use. They were at the present time busily engaged in erecting plant for the manufacture of water gas both at Brentford and Southall. They learnt from the experience of others that water gas was a most valuable enricher; it could be made very rapidly; and there was no objection to it in any way. The result of the half-year's working had been that, in spite of the fall in the value of residuals, they had an increase in the profit, compared with the June half of 1896, of about £5000. They did not make the sum required for the dividends proposed by about £2882; but they were marching very fast in that direction. As time went on he hoped to do more than that; and that was to make out of their profits sufficient to allow of additions to the reserve fund. After paying the dividend, they would carry forward a balance of £23,772. He hoped the proprietors would consider this a satisfactory statement. There was one other matter he should like to introduce to their notice, and it was that the capital per ton of coal had been reduced to £6 7s. 3d., which was the lowest point they had ever arrived at; and he hoped they would reach a smaller figure still.

Sir R. H. WYATT seconded the motion.

Mr. ROKEBY PRICE endorsed the remarks the Chairman had made with reference to the late Mr. Phillips. He also said the Board had made a good selection in appointing Mr. Morris to succeed him, as manufacturing companies of this kind required someone with experience on the Board. He was glad the Directors had not followed the example of The Gaslight and Coke Company in "knocking off" the meter rental, as he did not think it made the consumers at all grateful. They had in the past half year the sum of £5464 credited for meter rental; and, in his opinion, the Directors were doing right in continuing it. As to the remark of the Chairman regarding the reserve fund, the Board were doing well in looking after that, as, in the case of a manufacturing company such a fund was a strong backbone.

The CHAIRMAN agreed with the remarks of Mr. Rokeby Price, with the exception of those referring to the abolition of meter-rents by The Gaslight and Coke Company. Meter-rents were a proper charge in many ways; but in the case of The Gaslight and Coke Company, the consumers in the City used to have their meters free, while those outside the City were charged for them. Consequently, the Company were often taunted over that. The Directors discussed the matter, and came to the conclusion that it was only fair that the consumers outside the City should be on the same terms as those in the City. As some of those present might remember, the Great Central Company competed for the supply of gas without meter-rents.

The motion was unanimously carried.

Dividends at the rate of 5 per cent. per annum on the preference stock, of 12 per cent. on the consolidated stock, and 9 per cent. on the new stock were declared.

The usual complimentary vote to the Chairman and Directors and Officers terminated the proceedings.

BROMLEY GAS CONSUMERS' COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held last Thursday, at the Bell Hotel, Bromley, Kent—Mr. ALEXANDER DICKSON in the chair.

The SECRETARY (Mr. H. W. Amos) having read the notice convening the meeting, the Directors' report and the accounts, of which the principal features were given in last week's issue, were taken as read.

The CHAIRMAN, in moving the adoption of the report, said the shareholders would have seen from it that there had been a very satisfactory increase in the business during the six months; the consumption of gas having been 7 million cubic feet above that of the corresponding period of last year. This additional sale of gas brought them an increased

rental of about £1150; and a small addition to the income from meter-rentals (£32). Their realizations from the sale of coke had been nearly £500 better than in the June half of last year, when, as would be remembered, the price was unusually low. Then they had two or three slight variations in other items on the same side of the account. Sulphate of ammonia had advanced, and that was all one could say; the advance was so slight that it was scarcely perceptible. The price was very depressing to those who had to manufacture sulphate; and it seemed as if its prospect of regaining its old position was a very dim one. Tar had produced a little less this time; but, putting the advantages against the disadvantages, they had obtained a net increase in revenue of £1627. In the items of expenditure, they had, of course, an increase in the cost of coal—about £600—owing to the additional quantity of gas required. The other increases were not large. The item of maintenance and repair of works, machines, and retorts was rather more than £400 higher; but he ought to say that, finding themselves in a better position in the past half year as compared with previous periods, the Directors had, as prudent men, thought it desirable to strengthen the Company's position as much as possible. Therefore, in this item they had written off some of the cost charges of revenue plant; and so the Company would stand to that extent in a better position in the future. As he had said, the augmentation on the rental was £1627; and the increased cost was £1051, which gave them an advantage of about £576 on the revenue balance of the half year. Therefore, in the profit and loss account, there was this advantage in the net result, after providing for dividends at the same rates as heretofore. He thought it would be gratifying to the shareholders to see from the accounts that the slight pressure they experienced after expending a large amount of capital in the extension of the works had now gradually passed away; and they were getting into easier conditions of revenue than they were in at that time. Regarding the works, he was pleased to say they were in excellent order; and the Company were quite prepared for any amount of business in the way of supplying gas that the residents in the district presented them with. He saw from the reports of the proceedings of the District Council, that the Electric Lighting Provisional Order which they obtained some years ago, and upon which they hoped to be able to do some business, was about to be transferred. He thought it might be assumed, from the response that was made to the inquiries of the Local Authority, that there was indeed very little prospect of any important business being done in electric lighting in the district. He might say also that the Directors had offered to provide facilities for those who wanted the electric light by the use of gas-engines; but, although they had put forward every inducement in this direction, there had been no response to any extent. The Local Authority did not ask the Gas Company if they would like to take over the Order. For his own part, if there was any business of importance to be done, he did not see why the Company could not undertake the electric light supply, as had been done by the Birmingham and other gas authorities. He thought, however, they might come to a pretty sound conclusion that there was scarcely any prospect of remunerative business being done with the electric light in the district; and he ventured to say that, as the existing lighting authority, they had no fear whatever of any competition which might be started against them. When they came to look at the cost of the electric light as compared with that of gas light, it was obvious they had a considerable advantage in supplying consumers at a much cheaper rate. He concluded by quoting the figures published in the "JOURNAL" for March 30 last (p. 734) as to the relative cost of the electric light and incandescent gas-lamps.

The DEPUTY-CHAIRMAN (Mr. B. H. Latter) seconded the motion.

The CHAIRMAN, replying to questions, said they had only seen from the newspapers that the District Council were contemplating the transfer of their Electric Lighting Order to "an approved company." He had stated that there had not been a formal application to the Gas Company; but he would not say there had been no informal intimation. Of course, there was this preliminary difficulty, that the Company could not take over the Order without the authority of Parliament; so that it would necessitate an application for further powers. But this was a difficulty that, if there was a desire for the electric light and a prospect of business, the Company could possibly surmount.

The resolution was unanimously agreed to.

Dividends at the rates of 11½ per cent. per annum on the ordinary 10 per cent. shares, and 8½ per cent. on the ordinary 7 per cent. shares, were declared.

On the proposition of Mr. W. SUTTON, seconded by Mr. H. WYATT, a hearty vote of thanks was passed to the Chairman and Directors. Subsequently, a similar compliment was paid to the Engineer (Mr. W. Woodward), the Secretary, and their respective staffs.

SHEFFIELD UNITED GAS COMPANY.

Half-Yearly Report and Accounts.

In the report which the Directors of the above-named Company will present at the 85th ordinary general meeting of the shareholders on the 14th prox., they express their pleasure at being able to record a continuous expansion of the Company's business; the increased quantity of gas sold during the six months ending June 30 having amounted to 105,959,000 cubic feet, or 11·15 per cent., more than during the corresponding period of 1896. The income shows an increase of £5042, which would have been larger to the extent of £5626 but for the reduction of 2d. per 1000 cubic feet in the price, dating from April 1 last year. The total receipts in the six months amounted to £146,881; and the expenditure was £105,849—leaving a balance of £41,032 to go to the profit and loss account. The profit for the half year is sufficient to pay the usual dividends, and leave £1952 to be added to the balance carried forward in January last. A sum of £14,602 was expended on new buildings and plant; the total outlay on capital account being increased, with the money spent on mains and services, meters, and stoves, to £772,122; leaving £64,558 unexpended of the total capital called up. Under the supervision of Mr. Fletcher W. Stevenson, M.Inst.C.E., the Company's Engineer, there were 87,857 tons of coal and 21,945 tons of cannel carbonized. The estimated quantities of residuals produced were: Coke and breeze, 65,882 tons; tar, 7094 tons; ammoniacal liquor, 3,387,000 gallons.

PROVINCIAL GAS AND WATER COMPANIES.

We commence to-day our usual notes as to the progress during the past half year of Gas and Water Companies in various parts of the country whose reports and accounts come to hand about this time.

Gas Companies.

The annual report of the Ashford Gas Company—the last that will be issued—has been presented to the shareholders. It is accompanied by a balance-sheet which provides for a dividend of 10 per cent., and discloses the fact that the Company's parliamentary expenses amounted to £1210. The balance in favour of the Company, according to the cash account, is £514; whereas a dividend of 10 per cent. will require £2070. But certain sums included in the payments belong to capital rather than income. In the assets and liabilities account, there is a credit balance of £5377. The Directors' report does not deal with the year's working; but simply refers to the arbitration case and the business connected with the transfer of the undertaking to the Local Authority.

The revenue of the Bath Gas Company in the six months ending June 30 amounted to £33,082; the expenditure, to £25,629—leaving a balance of £7453. There was an increased gas-rental, resulting from the continued use of gas for cooking and heating purposes, and its consumption through prepayment meters. The residuals produced rather more than in the first half of 1896, as far as coke and tar were concerned; but sulphate was, of course, in an unsatisfactory condition. The Directors recommend the declaration of maximum dividends.

At the annual meeting to-day of the Bridport Gas Company, Limited, the Directors will report that the profit on the working in the twelve months ending June 30, with the balance brought forward, amounts to £1418. This enables them to recommend the declaration of dividends of 8 and 5 per cent. on the ordinary and preference shares, which will absorb £937, and leave £481 to be carried forward. The total revenue for the past year was £3654; the expenditure, £2705—leaving a balance of £949. The sale of gas to private consumers has increased by 619,000 cubic feet.

In the report to be presented at the half-yearly meeting of the Bristol Gas Company next Friday, the Directors state that, notwithstanding the reduction in the price of gas, the rental for the six months ending June is only slightly below that for the corresponding period of 1896. The total revenue was £122,710, as compared with £120,600; the expenditure, £94,263, against £89,619; and the balance carried to the profit and loss account, £28,447, against £30,981. The balance available for distribution is £37,175; and after paying the dividend on the ordinary stock (5 per cent.) and the interest on the debentures, there will remain £13,857 to the credit of the current account. The working statements show that 84,597 tons of coal and 8951 tons of cannel were carbonized or used in the period covered by the report; the quantities of residuals produced being estimated as follows: Ordinary coke, 53,667 tons; cannel coke, 3970 tons; breeze, 7352 tons; tar, 1,001,304 gallons; ammoniacal liquor, 1,992,386 gallons.

The shareholders of the Bury St. Edmund's Gas Company were in a position, at their recent meeting, to express their satisfaction with the condition of the business, and with the excellent management of Mr. Alex. Mitchell. The profit and loss account for the half year showed a balance of £4044, which was rather more than £200 higher than at the close of the previous six months. Dividends of 11s., 8s. 6d., and 8s. on the three classes of capital were declared.

The Chester United Gas Company held their half-yearly meeting on the 5th inst., when the Directors recommended the declaration of the statutory dividends on the ordinary stocks of the Company. The accounts showed receipts to the amount of £16,917, and an expenditure of £10,998; leaving a balance of £5919. The amount available for distribution was £4249. The dividends would amount to £3408, and leave a balance of £841 to be carried forward. The Chairman (Mr. J. Gamon), in moving the adoption of the report, referred to the increased use of prepayment meters, and to the augmentation in the bulk of gas manufactured in the past six months—being nearly 3 millions more than in the corresponding period of 1896. There were 66 more automatic cookers in use, and 26 new consumers. The automatic gas supply was satisfactory; and the sales, which up to this time last year were 642,360 cubic feet, were 1½ millions in the six months ending June. He referred to the reductions which had been made since 1880 in the price of gas—the last being the removal of the 3d. difference between the charge within and beyond the city. As from the 1st of June the Directors had increased the supply to prepayment meters from 20 feet to 25 feet for 1d.—being a reduction of about 25 per cent.; and now, after consideration, they had resolved to make a further reduction from the 1st of July of 3d. per 1000 cubic feet. There would be a slight re-adjustment of the discounts. The price would be 2s. 10d. to the small consumers, and to the largest still less; the nominal price being 2s. 11d. Sir T. G. Frost seconded the motion; and it was carried. Interim dividends for the half year were then declared as follows: 5 per cent. on the "A" stock; 3½ per cent. on the "B" and "C" stocks; and £1 3s. 4d. per cent. on £3900 of ordinary "C" stock.

The annual meeting of the Diss Gas Company was held on the 4th inst.—Mr. H. O. Lyns presiding. The statement of accounts as presented by Mr. H. E. Garrod, the Secretary, showed that the gas sold during the year amounted to £1396, as against £1299 in the previous twelve months. Notwithstanding that a heavy outlay was being incurred for repairs, it was resolved to declare a dividend at the rate of 8½ per cent per annum.

At the meeting of the Dorchester Gas Company last Tuesday, the Directors reported that the net profits on the working of the undertaking in the half year ending June 30 were sufficient to justify them in recommending the usual dividend of 10 per cent., free of income-tax, on the ordinary capital, and of 6 per cent., less income-tax, on the preference capital. They regarded this as very satisfactory, considering the present low prices ruling for residuals. The revenue in the above-named period amounted to £3126; the expenditure, to £2075—leaving a balance of £1051. The balance in hand for division was £1170.

The past year was, in spite of the low price of residuals, one of the most successful ever experienced by the Gravesend Gas Company; and the Chairman (Mr. M. A. Troughton), in consequence, heartily congratulated the shareholders at their recent meeting. The increase in the

consumption of gas—amounting to nearly 8 million cubic feet, or 7·55 per cent.—is the largest known by the Company; and the prepayment meters accounted for 2 millions of this. Residuals only produced 5s. 8d. per ton of coal carbonized, against 6s. 5d. the year before. Under the circumstances, the Chairman announced that the Directors had decided to reduce the price of gas 2d. per 1000 cubic feet from Midsummer last; and, in the case of prepayment consumers, 22 feet would now be given for 1d., instead of 20 feet. These reductions will cost the Company nearly £1000 a year; but the Chairman hoped that the increase in the consumption of gas in the future would somewhat reduce this amount. Should the value of residuals advance, the Directors hope to take another 1d. off the price of gas next year.

In their annual report, the Directors of the Holyhead and North Wales Gas and Water Corporation state that they consider the balance-sheet (which shows a net profit of £2699) to be highly satisfactory, more particularly in view of the time and expense necessarily incurred in getting the various stations into thorough working order, and assimilating in one uniform system a large number of undertakings that had hitherto been carried on upon totally diverse lines. The organization of the Company's properties is now complete; and the Directors anticipate that ere the period for which the dividend is secured expires, the operations of the Corporation will show a profit in excess of the guaranteed dividend of 6 per cent. which (for the year ending March 31 last) will be declared at the annual meeting. An interim dividend at the rate mentioned has already been paid.

The annual general meeting of the Leatherhead Gas Company was held on Tuesday evening, under the presidency of Mr. G. Brown. The Directors in their report expressed their confidence in the policy which had led to the reconstruction of the Company under the present title. The receipts, including £3313 from the sale of gas, amounted to £4075; the expenditure to £3058—showing a balance of £1017. During the year, 18,898,600 cubic feet of gas were made; this being an increase of 6,372,900 cubic feet over that produced in 1887. A dividend at the rate of 4s. per share was declared; the Secretary (Mr. T. Haynes) pointing out that this corresponded with that of last year, when a dividend of 8s. was declared, as the holder of 10 shares then now held 20.

The ordinary general meeting of the Littlehampton Gas Company was held on the 4th inst. The report presented stated that the quantity of gas sold during the past year amounted to 18,908,975 cubic feet; being an increase of 2,648,000 cubic feet. A considerable outlay had been involved by the renewal of plant; but the steady increase in the sale of gas had warranted a reduction of 2d. per 1000 cubic feet in the price of gas. Dividends at the rates of 10 and 7 per cent. were declared on the original and ordinary shares respectively.

At the meeting of the Maidstone Gas Company last Thursday, the accounts presented showed a balance of £13,429 available for distribution; and the Directors recommended the declaration of a dividend (less income-tax) for the year ending June 30 at the rate of 11 per cent. per annum, of which 5 per cent. was paid as an interim dividend in March. The revenue from the supply of gas for public and private lighting was £25,579; and the total receipts were £35,761. The expenditure being £27,139, there was a balance of £8622 to go to the profit and loss account. Under the supervision of Mr. H. Smythe, the Company's Engineer and Manager, the works, plant, and mains have been kept in good order and condition.

The half-yearly general meeting of the Newport (Mon.) Gas Company was held on Monday last week—Mr. E. J. Phillips, J.P., in the chair. In moving the adoption of the report and accounts, the Chairman said the latter showed an increase over the corresponding period of 1896. In that half year, they had an advance as compared with the first six months of 1895, and now there was a further increase of £600; so that they were in a better position than they had been for some years. The amount required to pay the interest and dividends on debenture stock was £5228; but they had exceeded this by £1175. They had made 5,801,000 cubic feet more gas than in the corresponding half of last year; and it was to the credit of their Engineer (Mr. T. Canning, Assoc.M.Inst.C.E.) that this increase of 5 per cent. in the manufacture had been effected at a reduction in cost of about £50. They were making important alterations in their works by substituting regenerative furnaces for the old system; and they thought they were right in adopting the recommendation of the Engineer in this matter. Mr. Batchelor seconded the motion. He asked whether the Chairman had anything to say on the subject of electric lighting and its effect upon the Company. The motion having been carried, the Chairman said the best reply he could give to the question put to him was that the sale of gas was not diminishing, but steadily increasing. The Company's stock had never stood so high as it did now. The incandescent gas-light had advantages over the electric light; for the latter must necessarily throw a dark shadow, which the former did not do. In Paris, where electric lighting had been extensively adopted, they had gone back in many instances to incandescent gas, and the new light—the Denayrouze—was a really wonderful illuminant which was bound to come into use in the near future. The Chairman then moved the declaration of the usual dividends; and this was unanimously agreed to. In responding to a vote of thanks accorded to him for presiding, the Chairman remarked that, however earnestly the Directors had tried to look after the interests of the Company, they were dependent to a very great extent upon the valuable services of their Engineer and their Secretary (Mr. E F. Marfleet).

The Directors of the Normanton Gas Company report that the profits for the past half year amount to £1025; making the sum available for dividends £2949. The usual dividend of 8 per cent. is recommended; leaving £1949 to be carried forward. The Board have entered into an arrangement for enlarging the purifying plant, which, owing to increased consumption, was becoming inadequate. It is also stated that during the half year, a large number of prepayment meters have been fixed. It will be necessary to increase the capital; and the Directors propose asking the sanction of the stockholders to the raising of £3000 of loan capital.

The Directors of the Pontefract Gas Company report that for the half year ending June 30 the amount divisible among the shareholders is £1296, out of which they recommend a dividend at the rate of 10 per cent. per annum on the original shares, and 7 per cent. per annum on the new ordinary shares. The reserve fund amounts to £3033.

At the half-yearly meeting on the 9th inst., the Directors of the Town and County of Poole Gas Company reported a profit of £1240 on the working in the six months ending June 30, as compared with £1105 in the corresponding period of 1896. The revenue was £3629; and the expenditure, £2389. The balance available for distribution amounted to £5437, out of which the Directors recommended the payment of the maximum dividend (less income-tax) upon the whole of the "A" and "B" stocks and preference "C" shares.

At the half-yearly general meeting of the Rochester Gas Company last Thursday, the accounts presented showed receipts to the amount of £29,677 (£22,284 being for gas sold), and an expenditure of £26,595; leaving a balance of £3082. The amount available for distribution was £12,135; and the Directors recommended dividends at the rates of 10 and 7 per cent. per annum. The report was adopted.

At the annual general meeting of the Taunton Gas Company, on the 27th ult., the report and accounts presented by the Secretary and Manager (Mr. A. J. Edwards) showed that the quantity of gas sent out in the twelve months had been 65,773,200 cubic feet; and that 4¾ million cubic feet more gas had been made than in the corresponding period of 1895-6. The report went on to state that the application made to Parliament for authority to increase the capital of the Company had resulted successfully. The Directors had ordered additional plant for increasing the manufacturing capacity of the works; and it would be necessary in a short time to raise some of the new capital authorized, to meet the cost. The Directors recommended a dividend of 8 per cent. on the "A" stock, and of 7 per cent. on the new shares. The accounts showed that the year commenced with a balance in hand of £4387. The amount received from the Town Council for gas supplied to the public lamps had been £328; and that from private consumers, £11,407. The total receipts were £18,817; and after payment of dividends amounting to £2730, there would be a balance in hand of £4170. Mr. J. Barrett, who presided in the absence of the Chairman (Mr. J. H. B. Pinchard) through illness, in moving the adoption of the report, remarked that the shareholders had every reason to be well pleased with it and the accounts, for the large increase in the consumption of gas was most satisfactory. The report was adopted. The usual votes of thanks were accorded, and the energetic services of the officials and employees of the Company were duly acknowledged.

The income of the Yeadon and Guiseley Gas Company for the past six months amounted to £4806; and the total expenditure to £3284. The disposable balance is £1522; and the maximum dividends of 10 per cent. per annum on the consolidated stock and 7 per cent. on the new shares are recommended.

The York United Gaslight Company held their ordinary half-yearly meeting on the 5th inst.—Mr. J. F. Taylor in the chair. The Secretary and Manager (Mr. C. Sellers) read the Directors' report, which stated that the balance of the revenue account carried to the profit and loss account amounted to £8017; and when to this amount was added £243, the interest from the reserve investment fund, there would be a total profit of £8260 to meet the shareholders' dividend and interest upon money borrowed on mortgage. The Directors recommended the payment of the usual half-year's dividend of 5s. per share upon both the old and new shares, free of income-tax. The reduction of 2d. per 1000 cubic feet in the price of gas, which came into force at the beginning of the past half year, had been largely met by increased consumption owing to the long, cold, and dull spring, and to the fact that the Company's residuals had been nearly all sold and credited in the six months, and not as was frequently the case, partly stocked and sold to the credit of the following half year. The surplus profit, therefore, of £965 over the amount required for dividend and interest (£7295) was more apparent than real, and should be read as part of the year's results; the June half year being always the best for profit. The increase in consumption had been nearly 10 per cent., in contrast with more than 2 per cent. decrease in the corresponding half of 1896. The Chairman, in moving the adoption of the report, remarked that the modest dividend had been earned, and the public had been supplied with gas, he thought he might say, at about the lowest price in the kingdom. In this respect two bodies of interested individuals—the shareholders and the consumers—had reason to be fairly and mutually satisfied. The increase in gas consumption—nearly 10 per cent.—in the half year was exceptional, and, as pointed out in the report, was partly owing to the dull weather in the spring. The June half was decidedly the best for profit; and therefore he must caution the proprietors not to be misled by the little surplus beyond the dividend in the period just closed. They would require it, and probably more, to meet the dividend next February. The report was adopted.

Water Companies.

The business of the Broadstairs Water Company continues to steadily increase. The past half-year's working gave an available sum for appropriation of £1585, from which a dividend on the ordinary stock at the rate of 5 per cent. per annum has been declared. After paying this and the dividend on the preference and debenture stock, a balance of £968 remains to be carried forward.

The Cambridge Water Company have declared a dividend for the past half year at the rate of 10 per cent. per annum on the consolidated stock, and at 7 per cent. on the amount called up on the new £10 shares. The plant has been improved by the laying of additional trunk mains; and larger pumps have been fixed to the two engines at the Fulbourn pumping-station, at an estimated cost of £1200. Each of the pumps will deliver 750,000 gallons of water in twelve hours. In order to meet the requirements on capital account, the Directors propose to make a final call of 10s. per share on the new shares. During the half year, 188 new premises were connected to the Company's system; making the total supplied 14,610.

The trading of the Chester Water-Works Company in the past half year resulted in a surplus of revenue over expenditure of £2596, which, added to the balance from the previous account, made a total of £9872. The dividends paid in February last absorbed £2340; and the interest on the preference capital, £450—leaving a balance of £7082. From this the usual statutory dividends have been declared; and, after paying them, £5192 will remain to be carried forward. At the meeting of the shareholders, the Chairman (Mr. W. Brown) referred to the improvements which had been made at the works, and to the extension of the distribution area. For the first time, he also made some remarks on the late water scare, which the reports of such eminent men as Sir Henry Roscoe and Dr. Percy F. Frankland have proved was the result of

ignorance. The harm done to the Company was a small matter; but it amounted to some £200 a year through voids by large houses being unoccupied. The loss to landlords in rents and to the city in spending power was, said the Chairman, simply incalculable; and there was no telling where the mischief ended. The Directors had entered into an agreement to pay a sum not exceeding £500 for three years, and after that not exceeding £300 a year, if the County Council would free the river from pollution—that was to say, if they could allay the unfounded fears for ever, it would be to the advantage of the Company to pay this amount. Although, as he said, these scares had damaged the Company to the extent of £200 a year, the landlords must have suffered to the extent of £2000 in rents; and as the residents represented by this rent also possessed large purchasing power, it was incumbent upon them to do all they could to allay fears respecting the purity of the Chester water. The report and accounts were adopted.

The Directors of the East Worcestershire Water-Works Company report that during last half year 261 additional services were laid, raising the total to 4445, exclusive of Droitwich and Rednal. The average daily quantity of water pumped has been 606,380 gallons. From the accounts, it appears that there is a considerable increase in the rates and taxes accrued for the half year, attributable to a very large increase in the assessment of the works and mains. The profit for the six months has been £1411, which, added to £1537 brought forward from the last account, makes a disposable balance of £2948. It is now proposed to pay a dividend for the twelve months of 3 per cent. free of income-tax, £1850; to add to the depreciation reserve fund £631; and to carry forward the balance, amounting to £466. The Directors propose asking the shareholders to sanction the issue of £10,000 of 3 per cent. debenture stock. At present £8000 will be raised for the purpose of repaying mortgage loans obtained some years ago, and which have been carrying a higher rate of interest.

At the close of last half-year, the Grantham Water Company had a balance to the credit of the revenue account of £6284, of which £1750 is to be applied to the payment of a dividend of 5 per cent.

The report submitted by the Directors of the North Shields Water Company at the recent annual meeting of shareholders, stated that the gross revenue for the year amounted to £11,597; and the expenditure, including an amount paid to the Newcastle and Gateshead Water Company, and interest on loans, to £8930—leaving a balance of £2667. The interim dividend of 1½ per cent. paid in January amounted to £900, which left £1767. Adding to this £429, the balance from the previous year, a sum of £2196 remained to the credit of profit and loss account. The Directors recommended the payment of a further dividend of 1½ per cent., making 3 per cent. for the year, and absorbing £900. The Right Hon. Earl Percy being entitled to £574 for one-seventh share of the clear annual profit, a balance of £721 remained to be carried forward. The Directors referred to the purchase of the works by the Tynemouth Corporation, which subject also occupied the major portion of the Chairman's (Mr. Seymour Bell's) speech in moving the adoption of the report. Having described the progress of the Corporation Bill through its various stages, the Chairman said the Corporation had obtained their Act; and as soon as it received the Royal Assent, they would give the Company notice to arbitrate under the Lands Clauses Act, in order to fix the value of the undertaking. As to the past year's working, the Chairman spoke with satisfaction of the steady increase in the number of consumers, and the substantial decrease in expenditure. Altogether the position and prospects of the concern were distinctly good; and if only they had been able to get rid of the Lord of the Manor's seventh share of the profits, he had no hesitation in saying they would by this time have placed the Company on such a basis as would have been satisfactory to the local authorities and the public at large, as well as remunerative to the shareholders. The report was adopted; and the dividend recommended declared.

The report to be presented to the shareholders of the South Staffordshire Water Company on the 26th inst. states that the number of houses laid on during the half year ended June 30 was 1174, making the total supplied 93,181. The gross amount of water-rates for the six months was £47,593, as against £45,454 in the corresponding period of the previous year. After providing for interest on debentures and preference stock, the amount remaining for division (including £4356 brought forward) is £22,300; and the Directors recommend the declaration of a dividend for the half year on the ordinary stock at the rate of 6 per cent. per annum, less income-tax. The amount of this dividend being £17,255, there will remain £5045 to the credit of the next half year. The Engineer (Mr. H. Ashton Hill, M.Inst.C.E.) reports that the whole of the machinery, buildings, and reservoirs of the Company are in substantial order and repair.

The half-yearly accounts of the Yeadon Water Company show receipts amounting to £1528, and an expenditure of £549; leaving a profit of £979. With the balance brought forward, there is an available sum of £1127, of which it is proposed to distribute £917 in the payment of dividends at the rates of 5 and 3½ per cent. per annum on the two classes of capital.

The last half-yearly report of the Directors of the York Water Company states that the entire cost of the new engine and boilers has now been defrayed, but there is a small balance to be paid when the final account is rendered in respect of the new engine-house. The Directors recommend that dividends for the past half year be declared, without any deduction for income-tax, at the following rates: On the preference shares, 1876, at 5 per cent. per annum; do., 1896, at 3½ per cent. per annum; on the ordinary shares, at 10 per cent. per annum; and on the new shares, 1878 and 1879, at 7 per cent. per annum. The balance available for the purpose is £7209.

Bromley Gas Workers' Summer Outing.—Last Saturday week, the yard men employed by the Bromley Gas Consumers' Company, to the number of about 120, enjoyed, by the liberality of the Directors, an excursion to Margate and Ramsgate, accompanied by Mr. Woodward, the Engineer. The fares of the men were paid; and, instead of the dinner customary on such occasions, each man was provided with a sum of money for his meals—this plan being regarded with more favour by the men, as it enables them to take their wives with them. The stokers did not participate in the outing, as they have a week's holiday in the summer.

ACCRINGTON GAS AND WATER SUPPLY.

The First Year's Working of the Board—Abolition of Gas-Meter Rents.

At the last Meeting of the Accrington District Gas and Water Board, the question of abolishing gas-meter rents was again under consideration. Some time ago, when the matter was dealt with, it was resolved that nothing should be done until the annual financial statement of the Board was published. This having now been issued, and showing a gross profit of £17,905, the Board resolved, after a short discussion, to abolish the meter-rents as from Dec. 31 next. The statement, which deals with the first complete year's working of the Board, shows that 27,520 tons of coal were carbonized; producing 289,636,000 cubic feet of gas, or 10,524 cubic feet per ton. The quantity of gas sold is estimated at 268,000,000 cubic feet; the proportion taken by private consumers being 94·40 per cent., and that used for public lamps, 5·60 per cent. There are 60 miles of gas-mains laid in the district, supplying 13,913 customers and 1347 public lamps. Upwards of 221,000 cwt. of coke and breeze, 331,550 gallons of tar, and 913,905 gallons of ammoniacal liquor were produced. To provide for the growing consumption of gas in the districts, a new gasholder was erected at Great Harwood during the year—its capacity being a million cubic feet; and the Board have now in course of construction additional manufacturing, condensing, and purifying plant. This will be available for use in the coming winter. After paying £523 for interest on loans, annuities to the amount of £9342, and placing £2787 to the sinking fund, there remains a balance, or net profit, of £5252. The income from the sale of water during the twelve months amounted to £17,376—an increase of £1800 on the previous year. The gross profits were £13,133; but after paying £12,363 for interest and annuities, and placing £3412 to the sinking fund, there is a deficiency of £2683. This is, however, reduced by a balance of £1819 brought forward; the net deficiency therefore being £864.

ELECTRIC LIGHTING NOTES.

The Gas and Electric Lighting Committee of the Burnley Corporation have been considering the question of extending the electric light station and distribution system; and, on their recommendation, the Council have decided to apply to the Local Government Board for sanction to borrow £25,000 for these purposes.

Mr. J. T. Marsh, one of the Inspectors of the Local Government Board, has lately conducted an inquiry at Newport (Mon.) with reference to an application by the Town Council to borrow £31,000 for an extension of the electrical installation. The Town Clerk (Mr. Newman) gave the Inspector a short history of the installation, and said that £40,000 had been expended in providing the present supply. The increase in the number of lamps in the year ending June was equal to 50 per cent.; being the difference between 9252 lamps and 13,500 lamps. The annual loss on the undertaking, after providing for repayments, &c., had also been reduced from £1410 up to March, 1896, to £962 for the year ending March, 1897. There was every probability of expecting an increased demand in the near future equal to 50 per cent.; and to meet this the Corporation were without funds. Since the tenders had been invited for the building and machinery it had been found necessary to ask for a further loan of £5000 in addition to the £31,000. Mr. R. Hammond, the Consulting Engineer, then gave some detailed particulars as to the length of the mains and the proposed trebling of the plant.

There was a lot of bother last winter over the repeated failures of the electric light in Portsmouth. The cause of the breakdowns (says the "Hampshire Telegraph") resolved itself into this—that the machinery was insufficient and was overloaded; and some of the street cables were found to be defective. The Corporation Electric Lighting Committee at once set about remedying these deficiencies; and when they had new cables laid, and obtained sanction for and ordered new and additional machinery, they thought their difficulties would be at an end. But something unlooked-for has occurred. Two of the contracting firms are now affected by the engineering dispute, and have given notice that they will consequently be unable to deliver the machinery until after the dispute is settled. The Committee are in an awkward position for, if the engineering dead-lock should last many weeks longer, the dark winter evenings will have closed in, and there will be an increased demand for light from a larger number of consumers, and the present machinery will be more overloaded than ever. Apparently (says the before-mentioned paper) the only thing the Committee will be able to do will be to ask their customers to use only two-thirds of the light they would ordinarily require.

An inquiry was held at Liverpool last Wednesday by Major-General H. D. Crozier, of the Local Government Board, respecting an application by the Corporation for sanction to borrow £100,000 for the purposes of electric lighting. It may be remembered that, under an Act obtained in 1896, the Corporation secured power to borrow £500,000 for purchasing the electric light undertaking and carrying it on. The sum of £400,000 was paid to the shareholders; and a further £36,474 was required for debts owing by the Company and money spent in excess of the share capital. Explaining the objects for which the loan now asked for was needed, the Town Clerk (Mr. H. E. Clare) stated that the actual capital expenditure had now been brought up to £479,000; but works were in progress involving a further estimated expenditure of £45,000, which would make the total capital expenditure exceed the present borrowing powers by £24,000. The reason the Corporation asked to be authorized to borrow the extra £76,000 was that they anticipated that within the next twelve or eighteen months it would be required in fulfilling the obligations cast upon them by their Electric Lighting Order, and in extending the undertaking in a manner which, it was believed, would be needed by the city. On July 1, 1896, the total number of lights fixed (including the street arc lamps) was 41,500; by Dec. 31, the number had been increased to 52,500; and by July 1 last, it had risen to 63,162. The accounts on Dec. 31 showed that, after paying interest and sinking fund out of the net revenue, there remained a surplus of £11,000 to the credit of the undertaking, which the Committee appropriated in this way: £5000 to renewal fund, and £6000 to the reserve fund. Replying to the Inspector the Town Clerk said none of the profits had been carried to the city fund.

Having regard to the satisfactory position in which the undertaking was, the Committee in April reduced the price for the ordinary supply from 7½d. to 6d. per unit for 1000 units per month, and from 7½d. to 4d. per unit in excess of 1000 per month. At the same time, the charges for electrical energy had been reduced from 5d. to 3d. per unit for the first 1000 units per month; and 2d. per unit for excess supplies. The Electrical Engineer (Mr. Bromley Holmes) and others gave evidence; and subsequently the generating-stations were visited by the Inspector.

LABOUR-SAVING MACHINERY IN GAS AND OTHER MANUFACTURES.

Visit of Engineers to the Transport Appliance Works, Smethwick.

On Friday afternoon an interesting gathering took place at the works of the New Conveyor Company, Limited, in Brook Street, Smethwick, known as the Transport Appliance Works. The Company, it may be remembered, removed their business from Aberdeen in 1896; having previously carried it on there for six years as engineers and constructors of conveyors, elevators, and all kinds of labour-saving appliances and machinery. The removal of the concern into the heart of Staffordshire has apparently been attended with most satisfactory results; for our representative who visited the works on Friday was informed that since their location in Smethwick, they had done as much business as they did in three years in Aberdeen. The main object in leaving Scotland was to be in close proximity to the coal and iron districts of South Staffordshire, and not so much with a desire to get near to the buyers, who are scattered all over the country and in foreign lands. As previously explained, the works are arranged chiefly for the manufacture of plant for conveying materials and the transmission of power, as well as for loading coal without the necessity for hand labour. They make numerous appliances for elevating coal, coke, &c., and other contrivances for reducing the cost of various manufactures. One of their chief specialities is their gas-works trade. The Company have erected in different parts of the country gas-works to be operated as far as possible in every department upon the automatic principle. There are other branches of manufacture, including conveyors for drying by steam in chambers. The Managing-Director is Mr. Gilbert Little, who has as his principal colleague Mr. Maurice Graham, and is also assisted by his sons. The new works being now in thorough order, a large number of the Company's customers and friends were invited to go round the establishment on Friday last, to view their specialities. The party, which included a number of gas engineers from various parts of the country, was conducted by Mr. Little, Mr. Maurice Graham, and Messrs. W. & A. Little. After the inspection, luncheon was served in the drawing office—Mr. Gilbert Little presiding. The toast of the day—"Success to the New Conveyor Company, Limited"—was proposed by Mr. J. B. Clarke, J.P., who remarked that the Company was bound up with Smethwick; and he expressed the hope that Smethwick was bound up with the Company. He wished the undertaking every possible success. Mr. Little, in reply, sketched the history of the Company from its formation in June, 1889, since which date they had, he said, received 2050 orders, 1400 of which were executed between that time and June, 1896, when they commenced operations in Smethwick. They had since had 640 orders, or, during the twelve months, a number equal to about half of those with which they were entrusted during the preceding six years. These orders related to every variety of industry. They had arranged the business in three distinct branches. The first was the department for the specialities for which the concern was primarily started—namely, machinery for the transmission of materials and power, conveyors, elevators, &c. The next was the gas-works appliances department, the origin of which was due to Mr. Graham, who was formerly Engineer of the Company who exploited inclined retorts; and it had been a great success. The third department was for specialities connected with the automatic cleaning and sizing of coal at collieries. Although there were three departments, they were three in one, as the gas-works transport machinery was only a heavier class of the Company's standard conveyors and elevators; and the apparatus for coal sizing and cleaning was in turn only a heavier kind than the gas-works types. In conclusion, he said the works could not be in a more suitable situation than Smethwick.

Winding Up of the Chesterfield Gas and Water Company.—In connection with the transfer of the works of the above Company to the Chesterfield Gas and Water Board, a meeting of the shareholders was held last Tuesday. It was announced that the ordinary shareholders were to receive another £1 per share; and it was expected that finally they would have a further 1s. per share. A sum of £1200 was voted to the Directors.

Gas Supply of Little Hulton.—At the last meeting of the Little Hulton District Council, there was a mixture of congratulation and complaint regarding the gas supply. This arose from the fact that the district is served by two authorities—in the one part by the Salford Corporation, and in the other by the Farnworth and Kersley Gas Company. From Salford the Council have secured a reduction of 1d. in the price of gas in connection with the Corporation Bill; and this concession was the subject of the congratulation. Referring to the matter, Mr. Dyson said that one portion of the district was reaping a great benefit by being supplied with Salford gas; while the other was not being so well treated. The price of the Salford gas had been reduced to 2s. 8d.; and there was a discount of 2d. which made it 2s. 6d. The Farnworth and Kersley Gas Company charged 3s. 3d., less 3d. discount—making a difference of 6d. as compared with Salford. At the most the Company had only to send the gas two miles, compared with eight miles from Salford; and besides the former had the cream of the district. If the Council wanted a few extra lamps erected, Farnworth made them pay, and Salford did not. Then Farnworth charged meter-rents, and Salford had abolished them. Yet the Company's shares were sold at over £180 per £100 share. It was, he thought, high time they tried to do something with the Company; and he would move that the Clerk write to the Farnworth and Kersley District Councils asking them to seriously consider the conditions of the gas supply, and to co-operate with Little Hulton in endeavouring to obtain better terms. This was unanimously adopted.

THE PROJECTED NEW WATER-WORKS FOR CROYDON.

Local Government Board Inquiry.

On Friday, the 6th inst., Mr. R. H. Bicknell, one of the Inspectors of the Local Government Board, concluded an inquiry into the application of the Croydon Town Council to borrow £32,000 for new water-works at Waddon. Mr. Balfour Browne, Q.C., and R. G. Glenn supported the application; Mr. R. Bray represented a number of riparian owners along the Wandle, who are opposed to the scheme. The Town Clerk Mr. E. Mawdesley) stated that the population of Croydon at the present time was 122,000; and the assessment for poor-rate, £725,567. The outstanding loans under the Public Health Act amounted to £692,328. Mr. Balfour Browne said that at the outset he should request that the mill and property owners along the Wandle be not heard at all, as the application was merely to borrow money, and therefore concerned the ratepayers of the borough only. The case for the Corporation was as follows: At present Croydon was supplied from two sources, which had become inadequate owing to the rapid growth of the population. They had bought six acres of land, and had actually sunk a boring and gone down 300 feet. The water stood at 49 feet from the surface; and he contended that they had a right to pump this well, and take every drop of water, even if it did affect the Wandle. Mr. Bray contended that his clients had *locus standi*. They would be very seriously affected by the scheme, as it was proposed to take 2 million gallons of water per day from these wells. The Inspector decided that the mill owners had no *locus standi*; but he said he would hear what the ratepayers had to say. Mr. Walker, M.Inst.C.E., the Borough Engineer of Croydon, deposed to the necessity of an improved and more adequate water supply, and said he did not think the water taken from the Waddon Wells would affect the Wandle. Mr. H. Martin, the Chairman of the Water Committee, supported the application. Sir F. J. Bramwell, F.R.S., said the Corporation had a copious supply of water at the Surrey Street source; but it was not desirable that they should try to obtain an increased supply there, as if they did it would increase the area of the cone of depression, which it was wise to avoid, as it might bring thick soil into play, and so contaminate the water. The prospects at Waddon were extremely good; and he did not think they would affect the Wandle. Mr. W. Whitaker, F.R.S., F.G.S., Mr. Edward Easton, M.Inst.C.E., and Professor Boyd Dawkins supported this evidence. The Inspector visited the site of the works. Mr. Bray said his clients opposed the application for two reasons—the one being because they considered a further supply of water for Croydon was not required. He argued that the present reserve supply was sufficient to carry them on for eight years at least. From the ratepayers' point of view, therefore, the expenditure of £32,000 was quite unnecessary. Another reason for objecting was because a doubt had arisen as to whether this water was safe now, and would continue so for ten or twenty years. The result of pumping at the well sunk would be to reduce the water in the Wandle, and would be a legal wrong for which there would be a remedy in the shape of an injunction. He contended that 30 gallons per head per day was an extravagant average. Mr. Baldwin Latham, M.Inst.C.E., who was for ten years Engineer to the Croydon Local Board, said he had lived in the town for more than thirty years, and he considered the greatest mistake he made was his recommendations with regard to the extension of the works at Surrey Street. The proposed new area of supply was as polluted as it could be, and the water came from exactly the same source as that in the Surrey Street wells. There were a large number of cesspools over this area, which could not be dealt with. Mr. Baker, who had had forty years' experience as an artesian well engineer, expressed the opinion that the Waddon area was polluted, and that the pumping would affect the Wandle. Mr. A. H. Smee thought 25 gallons per head per day should be an ample supply for Croydon. He supported the evidence given by the opposing witnesses. The inquiry then closed.

CARLISLE CORPORATION WATER SUPPLY.

The Proposed New Schemes.

In the "JOURNAL" for the 22nd of June, it was stated that the Gas and Water Engineer of the Carlisle Corporation (Mr. C. B. Newton, Assoc.M.Inst.C.E., F.C.S.) had submitted to the Committee three schemes for the improvement of the water supply of the city—viz., a gravitation supply from the River Gelt, a new pumping scheme on the River Eden above Wetheral, and an extension and improvement of the existing works. Mr. Newton's report on these schemes has since been printed, and we have received a copy.

Before dealing in detail with his proposals, Mr. Newton describes the existing works and the method of treating the water. The supply is at present taken from the Eden, and conveyed by a brick culvert into the subsiding reservoirs, two in number, having a working depth, between the draw-off pipe to the filters and the summer level of the river, of 3 ft. 3 in., and a combined capacity of about 1,500,000 gallons. Adjoining the subsiding reservoirs are two filters—No. 1 with a sand area of 13,800 square feet, and No. 2 having a sand area of 20,500 square feet. According to the speed of filtration approved by modern engineers and scientists—viz., not exceeding 50 gallons per square foot per 24 hours—the former is able to filter 690,000 gallons, and the latter 1,025,000 gallons per day, making a total of 1,715,000 gallons. After leaving the filters, the water enters the clear-water basin, from which it gravitates through a brick culvert to the wells beneath the pumps, passing under the bed of the River Petteril. The pumping plant consists of a 50-horse power Cornish engine, a 45-horse power vertical engine, one single-flue boiler, and two double-flue or Lancashire boilers. By the exercise of great care and attention on the part of the attendants, this machinery is able, under the present conditions, to deliver 1,250,000 gallons per day to the consumers. The service reservoir at Harraby Hill has a working capacity of 2,500,000 gallons. Its top water-line is at 124·7 feet above datum; and the draw-off pipe to the town is about 8 ft. 6 in. lower. Up to the present time, the works have been able to supply the needs of the inhabitants; but as the population continues to increase, it is necessary either to extend them or obtain a new supply.

In the first scheme submitted by Mr. Newton, it is proposed to obtain a supply of water, equal to 2½ million gallons daily, by gravitation from the River Gelt. This river is 13½ miles long from its source to its junction with the Irthing; and from this point to the Eden the distance is 3 miles. The water of the river is not used for manufacturing purposes; and the gathering-ground is remarkably free from contamination. There are a number of good springs in it. The upper waters of the Gelt consist of two streams, in which it is proposed to construct straining chambers, from which the water will be conveyed to a receiving chamber. Thence it will flow in a 20-inch pipe, having a gradient of 1 in 71, and a discharging capacity of about 9 million gallons per day, to the storage reservoir, which will be constructed in the Castle-Carrock Valley. It will have a capacity of 150 million gallons, and cover an area of about 40 acres. Filter-beds will be formed immediately below the embankment; and the water will be conveyed to the service reservoir near Cumwhinton in a 15-inch pipe about 12,200 yards long, having a mean gradient of 1 in 187, and a discharging capacity of about 2¾ million gallons per day. The proposed reservoir at Cumwhinton will have a capacity of 6 million gallons. An 18-inch main will be laid to connect this reservoir with the existing large mains at Harraby Hill. The total length of the pipe-line from the filters at Castle-Carrock to its junction with the present mains will be about 11½ miles. This scheme will provide an excellent supply of water collected from a gathering-ground of unsurpassed purity; and it is estimated to cost £129,320.

The second scheme is for furnishing the city with a supply of water taken from the Eden. The pumping-station will be placed at the side of the river about ten miles above the present intake. The works at the selected spot will consist of a straining chamber constructed at the edge of the river, and a culvert leading to the wells. The station will be furnished with three high-duty pumping-engines, each capable of delivering into the subsiding reservoirs 100,000 gallons of water per hour. The rising main will be about 500 yards in length. The storage and filtration works will consist of two subsiding reservoirs, each having a working capacity of 10 million gallons, filter-beds with clear-water basin, and a service reservoir capable of holding about 6 million gallons. The filter-beds will be eight in number, each having a sand area of 928 square yards, and being capable of efficiently filtering 417,000 gallons daily. Six filters will be in use at a time when the works are supplying 2½ million gallons per day, with the other two off work for cleaning, &c. The water will be conveyed from the service reservoir to Carlisle by an 18-inch main 7700 yards long, connected to the present system. By taking the water from the river at the point indicated, much pollution, both present and prospective, will be avoided; and the quality of the water should be very much superior to that obtained at the present intake. The estimate of the cost of these works is £90,577; but a modification of the scheme, which would yield 1,650,000 gallons per day, could be carried out for £65,989. Under this scheme, the subsiding reservoir will have a capacity of 10 million gallons; and it would be possible to abstain from taking water out of the river for six consecutive days. This long period of subsidence, with a crude water superior to that obtained at the present intake, together with perfect sand filtration, Mr. Newton thinks should allow of the distribution of water of very great purity.

The third scheme provides for extending and improving the existing works to yield a daily supply of 1,650,000 gallons. Mr. Newton recommends the repair and strengthening of the river intake works; an improvement of the culvert, and the building of new side walls to the old portion of the reservoirs and filters—removing the present sloping sides, and bringing the storage capacity up to nearly 5 million gallons; the construction of a pump-well connected to the intake culvert immediately behind the inlet sluices; and the erection of an engine-house furnished with a pair of gas-engines and centrifugal pumps. As the present filtering arrangements give considerable trouble and anxiety when one is shut off for cleaning, Mr. Newton proposes to divide the existing two filters into four, and add a new one. Their combined capacity will then be: Two of 375,000 gallons each, 750,000 gallons; three of 425,000 gallons each, 1,275,000 gallons—total, 2,025,000 gallons. Under the worst conditions, with one of the large filters off for cleaning, the capacity will be equal to 1,600,000 gallons. It is proposed to erect at the pumping-station two engines, each capable of delivering the maximum quantity of water. A new service reservoir will be constructed near Springfield, capable of holding 6 million gallons of water; and an 18-inch connecting main will be laid to the existing mains at Harraby Hill. The cost of this scheme is estimated at £38,679; and it will utilize to the greatest advantage the works already in the possession of the Corporation. Mr. Newton points out, however, that when completed the storage capacity will be much too small to be of real service in improving the quality of the water, and will not be large enough to obviate the necessity of taking turbid water from the river when the latter is in flood, as the storage of 5 million gallons will only suffice for three days' supply.

Appended to the report is a financial statement dealing with each of the schemes. The total annual outlay required for the first is put at £8384; for the second, as modified, at £6988; and for the third, at £6412. As the revenue from water-rents for the current year will probably reach £8600, the first scheme could be carried out not only without making any demand upon the rates, but it would allow of £220 being handed over to the district fund; and if the present rate of increase is maintained, there will in five years' time be a surplus of about £1500, which will expand further as the district develops. On the above basis, the modified second scheme would leave a present balance of £1612, and one of nearly £2900 in five years' time; and the third scheme, balances of £2188 and £4500 respectively.

Dr. Percy Frankland, F.R.S., has reported upon five samples of water submitted to him for analysis—one being the unfiltered water of the present supply, another being water drawn from the Eden ten miles from the present intakes, and the remainder being obtained from the Gelt and springs in the Gelt Valley. His conclusion is that, having regard to all the circumstances, the suggested removal of the intake would be only a half measure; whereas, from his knowledge of the Gelt and its contributory springs, he thinks that, in making any change in the present supply, it would be far more satisfactory in the end to abandon the Eden, with the unavoidable contamination to which it is subject, and provide Carlisle with a water supply above all suspicion of objectionable pollution, such as is obtainable from the Gelt, which, with ample storage and filtration, and the provision of suitable arrangements for excluding the peaty flood waters, would, he says, be unsurpassed by any water supply in the kingdom.

It has been decided to obtain the advice of Mr. E. M. Eaton, Assoc. M.Inst.C.E., on the schemes.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have received, per favour of Mr. James Fleming, the Treasurer, the accounts of the Gas and Electricity Committees of the Glasgow Corporation for the year ending May 31. I was able to give a summary of the gas accounts last week, and have but little to say about them now. I observe, from an abstract of all the accounts, that during the past year there was expended upon works £77,906. Mortgages, which since 1888 have stood at £100, have now disappeared, their place having been taken by Corporation loans, which, beginning in 1885-86 at £60,000, now amount to £590,000—as much as £70,000 having been added last year. The value of loans redeemed amounts to £248,435, at which figure it has stood for two years. The gross profits amounted to £101,939, as compared with £132,949 in the year preceding. This reduction in the profits is due to the lowering of the price of gas by 2d. per 1000 cubic feet last year, and to the decreased receipts from residuals. The amount written off for depreciation of works and plant came to £33,642, as compared with £66,156. Annuities and interest on loans reached £62,068, as compared with £61,090. The sum transferred to the sinking fund amounted to £5900, as compared with £5200. The amount upon which annuities are paid is £415,000, and the sum of the annuities is £34,762 10s. Of a total sum of £1,000,000 authorized, there has been borrowed £988,435, leaving £11,565 to be borrowed; but there have been redeemed loans to the amount of £248,435 in the gas account, leaving £590,000 remaining, all of which is borrowed at 3½ per cent. Of the loans, however, £149,400 was borrowed on behalf of the Electric Lighting Department, and of this sum, £3400 has been redeemed. The cost of the 554,517 tons of coal carbonized, including carriage, was £254,368. Purifying materials and oil, water, and sundries, cost £15,666; workmen's wages in the works, £82,197; and repairs and maintenance of works, plant, machines, apparatus, tools, materials, and labour, £51,170. The total cost of the manufacture of gas was £414,280. The total cost of distribution was £55,792. Rents and feu duties amounted to £7093; rates and taxes to £18,279; management to £9574; law and parliamentary charges to £402; and allowances to old servants of the Gas Companies to £261. The cost of coal was £15,874 more than in the previous year; wages of workmen on the works cost £5708 more; manufacture of gas £26,137 more; and distribution £1969 more. The sum realized for coke was £46,114, as against £41,508; and for ammoniacal liquor and tar £64,662, as compared with £70,937. Waste lime only fetched £8 12s. 5d., as compared with £321. In the Electricity Department, of a total of £200,000 authorized, £149,400 has been borrowed, and, as stated above, £3400 has been repaid. The rate of interest is 3 1/10 per cent. Mains and cables cost £63,123, and are now entered as of the value of £61,545, the sum of £1578 having been allowed for depreciation, which is calculated at 2½ per cent. The additions during the year amounted to £9451. Meters and certifying fees cost £6227, from which depreciation, at the rate of 7½ per cent., and amounting to £467 has been allowed, and an extra sum of £1500 has been set aside to meet renewals, leaving the present value at £4260. The additions during the year amounted to £4726. Electrical instruments cost £463, from which depreciation, at the rate of 5 per cent., and amounting to £23, has been deducted, leaving the present value £440. The additions during the year reached £48. The generation of electricity cost, for coal or other fuel, £2680; for oil, waste, &c., £436; for salaries, £224; for wages, £1995; and for repairs and maintenance, £1368; the total charge having been £6866. The distribution cost £1624, of which £1075 was expended upon repairs and maintenance of mains, cables, &c.; £433 upon repairs and maintenance of meters, &c.; and £115 upon salaries. Attending and repairing public lamps cost £449; royalties, £6 3s. 3d.; rents and feu duties, £205; rates, taxes, and assessments, £1393; and management, £1930. The total amount allowed for depreciation on works, machinery, mains, &c., is £10,705. Of the revenue of £30,474 there was derived from the rate of current, per meter, £27,289; from public lighting, £2912; from hire of meters, £212; and from the hire of electric lighting machinery, £61. The sinking fund now amounts to £6362. The accounts are prepared with the utmost care, and set forth lucidly the position of the undertakings, both of which, it is gratifying to observe, are in a flourishing state. They come before the Corporation at an early date for approval.

With regard to the manufacturing operations of the Gas Department, the Commissioners state in their annual report that the quantity of gas sold or accounted for during the past year was 4,625,781,000 cubic feet; being an increase, as compared with the previous year, of 366,612,000 cubic feet, or 8·6 per cent. The works extensions referred to in last year's report as being in course of construction have now been completed, and will be in full use during the coming season. These extensions are, however, no more than sufficient to meet the present demand. Additional purifiers have since been contracted for, and are being constructed at Tradeston and Dawsholm. Plans and specifications for an additional gasholder, which it is proposed to erect at the latter station, are almost completed; and its construction will be pushed forward with all possible speed. The necessity for these extensions will be evident when it is considered that the increase in the quantity of coal which it is necessary to carbonize to meet the demand for gas is from 30,000 to 40,000 tons per annum; and additional plant must annually be provided to deal with this quantity. About 20 miles of new mains were laid during the year, to meet the increasing demand for gas in several districts. The greatest quantity of gas sent out in 24 hours during the year was 28,873,800 cubic feet. The maximum daily make was 26,171,800 cubic feet. The number of meters in use on May 31 was 179,364; being 7736 more than the number in use at the same date in 1896. During the year 18,106 meters were repaired; and 24,656 were examined while in use, of which 20,819 were found in a satisfactory condition, and 3837 defective, and were removed. The number of gas-stoves let out on hire on May 31 last was 12,762; and the number of gas heating and cooking appliances sold during the year was 1526.

The accounts of the Gas Department of the Kilmarnock Corporation have been published. They show a revenue of £16,114, as compared with £15,632 reported a year ago; and an expenditure of £13,480, as compared with £12,665. The surplus on the year's working amounts to £2633, as compared with £2967. Out of the surplus, £53 has been set aside to meet irrecoverable sums; and £112 has been expended upon extensions; making, together, £166. But from this there has to be deducted £58 received for sundries, leaving £107. Adding the balance of £10,089 at the credit of profit and loss account, to the £2526 brought out, there is a balance in hand of £12,616. There has been paid to account of the new holder and manager's house, £6268. When the final accounts for these extraordinary expenditures are paid, profit and loss account will then be debited with the total cost. In accordance with the resolution of the Town Council, the price of gas was reduced from 3s. 1½d. to 2s. 8½d. in the middle of March, which lessened the profit by £380. The total quantity of coal used was 11,550 tons, as against 10,008 tons in the previous year; the increase being due to the larger consumption of gas. The price paid for coal was £6063, compared with £5504. The average price per ton was 10s. 6d., as against 11s. The quantity of gas manufactured was 102,890,900 cubic feet, or an increase of 6,684,200 cubic feet upon the previous year, equal to 6½ per cent. The average production per ton of coal carbonized was 9000 cubic feet. Gas sold amounted to 91,179,200 cubic feet, or an increase of 4,735,600 cubic feet, equal to 5·20 per cent. The gas sold per ton of coal carbonized was 8000 cubic feet. The difference between the gas registered per station meter and by consumers' meters was 11,711,700 cubic feet, equal to a leakage of 12¾ per cent., and fully 2 per cent. over that of last year. The increase in leakage was caused by the alteration of the survey, as well as by having a much larger stock of gas on hand at balance; the new holder, which contains 470,000 cubic feet, being full. The wages account amounted to £3277, an increase of £194, which was due to the larger consumption of gas. The total quantity of tar produced was 159,762 gallons, an increase of 7922 gallons. The revenue from tar was £986, an increase of £135, due to the increased quantity and the higher price obtained. The average quantity of tar produced per ton of coal carbonized was about 14 gallons; being 1 gallon less per ton. The total make of sulphate of ammonia was 116 tons, an increase of 13 tons. The revenue from this product was £905, as against £910; the average price being under £8 per ton, as against £8 16s. 8¾d. in the previous year. The average production of sulphate per ton of coal carbonized was 23½ lbs., as against 23 lbs. Of the total revenue, £13,866 was derived from gas, £1604 from residuals, and £538 from char. The accounts were approved of.

The Kilsyth Gas Commissioners are in course of erecting a new gasholder, which is expected to be completed by the end of October. This week they resolved to borrow £2000 to defray the cost; and power was given to a Committee to negotiate a loan for the amount, at 3 per cent. interest, or at most 3⅛; but if money cannot be got at that rate, the matter is to be returned to the Commissioners. The period of repayment is proposed to be 30 years.

Unless litigation should follow, what appears to be the last phase of the abortive gas transfer at Stirling, at this stage at least, was reached on Monday, when a special meeting of the Town Council was held, to consider (1) whether the expenses of promoting the Bill in name of the Commissioners of the burgh in session 1897 of Parliament to acquire the Stirling Gas-Works for the burgh, and all other expenses incurred in connection with such proposed acquisition, including therein the expenses of the arbitration between the Commissioners and the Gas Company, shall be paid by the Town Council out of the Common Good of the burgh, and, if agreed, to resolve accordingly, and to instruct payment of the said expenses; (2) to resolve to borrow the sum of £3000 to pay the said expenses from any person or persons willing to lend the said sum, and to authorize the Town Chamberlain to grant a bond or bonds in the usual terms in favour of the lender or lenders; (3) to remit to the Finance Committee, with powers to see the foregoing resolutions carried out. Provost Kinross said that in consequence of the desire expressed at a private meeting the previous week by some of the minority, he had submitted an AB memorial to Mr. J. B. Balfour, Q.C., which he read along with the answer given by Counsel to the queries annexed to the narrative. Mr. Balfour's opinion was to the effect that while the Commissioners of Police might be entitled to charge to the rates the expense of valuing the gas-works, it would not be legal for them to assess for the costs either of the reference to Sheriff Lees or the expenses of the Bill in Parliament. He thought, however, these expenses could be paid by the Town Council out of the Common Good of the burgh. It was stated that, roughly speaking, the costs of the reference would amount to £1000 and the Bill to £2000. Treasurer Colquhoun moved that the money be paid out of the Common Good. He stated that the burgh debt stood at £7732, and this was sufficient for revenue to pay the interest on the money borrowed, and £400 per annum to a sinking fund for redeeming the debt. Councillor Buchanan thought it would have been more satisfactory to the Council and to the public if the memorial had been prepared by a Committee consisting of an equal number of the majority and the minority; but, as his suggestion to take the opinion of Counsel had been adopted by the Provost, he would not move an amendment. The resolutions given above were then declared carried—Bailies Macewen and Wingate and some others entering their dissent.

The price of gas in Denny has been fixed at 3s. 9d. per 1000 cubic feet. Commenting upon this, a local writer recalls the fact that in 1862, when the present works were erected by the New Gas Company, the price charged for gas was 7s. 6d., or exactly double what it is now. The New Company were to reduce the price by 3s. per 1000 cubic feet. Although matters were not so successful, for a time, as the New Company anticipated, the old Company at last gave way and was brought to a close, and, shortly afterwards, the Corporation acquired the undertaking of the New Company, with, as has proved, the best results to the community.

At a meeting of the Brechin Police Commission on Monday a draft agreement between the Corporation and Messrs. Edmundsons, Limited, London, relating to a proposal for the supply of electricity to the town, was submitted. It was stated that all the alterations which had been made on the draft were in the interests of the Commission. One of these, and the most important, was that the cost of lighting the public lamps by electricity shall not exceed that of lighting them by gas. If this should be accomplished in Brechin, the Police Commissioners might

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 369).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	106—108	..	4 12 8
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9½—10	..	7 0 0
100,000	Stck.	29 June	5	Do. 5 p. c. Deb. Stk	103—106	..	4 14 4
200,000	5	27 May	6½	Bombay, Limited	6⅞—7⅛	..	4 9 7
40,000	5	,,	6½	Do. New, £4 paid	5¼—5⅜	..	4 10 7
380,000	Stck.	26 Feb.	12	Brentford Consolidated	300—305	..	3 18 8
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	115—150	..	3 6 8
159,375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	135—139	..	2 17 6
820,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	201—206	..	4 2 6
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11½	British	56—57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18—20	..	4 7 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10½—11½	..	5 4 4
200,000	100	1 July	6	Do. 6 p. c. Deb.	—	..	—
150,000	20	15 July	8½	Cagliari, Limited	30—32	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16½—17½	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	58½—59½	+½	5 0 10
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	343—348	..	3 17 6
165,000	,,	,,	10½	Do. New do.	257—262	..	4 0 1
165,000	,,	11 June	4½	Do. 4½ p. c. Deb. do.	155—158	..	2 16 11
800,000	Stck.	11 June	13	Continental Union, Limited.	255—260	+2	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	213—218	+1	4 11 8
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.,	317—322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	12 Aug.	5¼	Crystal Palace Ord. 5 p.c. Stk	137—140*	+½	3 15 0
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143*	+2½	3 9 11
486,090	10	29 July	11	European, Limited	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	17⅞—18⅞	..	4 9 3
5,896,590	Stck.	12 Aug.	12¾	Gaslight & Coke, A, Ordinary	313—316*	+6	4 0 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	113—118*	+2	3 7 10
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	315—320*	+2	3 2 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155*	+2½	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225*	+3¾	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	202—207*	+½	3 7 8
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	315—320*	+3	3 2 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	180—185*	+1	3 4 10
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	138—141	..	2 16 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	155—158	..	2 16 11
908,000	,,	,,	6	Do. 6 p. c. do.	207—212	..	2 16 7
70,000	10	13 May	6	Hongkong & China, Limited	13½—14½	..	4 2 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	13 May	10	Imperial Continental	213—218	–5	4 11 8
376,400	100	3 Aug.	4	Do. 4 p. c. Debs. Red.	99—102	..	3 18 5
473,600	Stck.	12 Aug.	3½	Do. 3½ p. c. Deb. Stk ,,	103—106*	+¾	3 6 0
75,000	5	29 June	6	Malta & Mediterranean, Ltd.	5½—6	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112—114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	108—110	+1	4 1 10
541,920	20	11 June	5	Monte Video, Limited	15—16	..	6 5 0
150,000	5	27 May	8	Oriental, Limited	8¼—8⅜	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7⅛—7¼	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1⅞—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	4¾—5¼	–¼	6 13 4
420,000	100	3 May	6	People's Gas } 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 June	6	of Chicago } 2nd Do.	105—110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14½—15½	..	6 9 0
5,475,000	Stck.	12 Aug.	5¼	South Metrop., 4 p.c. Ord.	144—147*	+½	3 11 5
1,416,667	,,	15 July	3	Do. 3 p.c. Deb. Stk.	105—109	..	2 15 0
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,000	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited.	13¾—14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	29 June	10⅜	Chelsea, Ordinary	335—339	+1	3 1 10
150,000	,,	,,	5	Do. 5 p. c. Pref.	177—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	157—160	..	2 16 3
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	225—229	+1½	3 1 1
654,740	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	163—166	..	2 14 3
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106½—107½	..	2 15 10
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	120—125	..	3 0 0
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Aug.	13	Kent	347—352*	+6½	3 13 10
160,000	,,	,,	7	Do. New, 7 p. c. max.	210—215*	+1½	3 5 1
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	285—290	..	3 7 2
406,200	100	,,	7⅛	Do. 7½ p. c. max.	217—222	..	3 7 7
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Aug.	13	New River, New Shares.	432—437*	+1½	2 19 6
1,000,000	Stck.	29 July	4	Do. 4 p. c. Deb. Stk.	151—154	..	2 11 11
902,300	Stck.	29 June	5	S'thwk & V'xhall, Ordinary	160—163	..	3 1 3
126,500	100	,,	5	Do. Do. 7½ p. c. Max.	151—154	..	3 4 11
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	173—178	..	2 16 2
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 June	10	West Middlesex	312—317	..	3 3 1
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—166	..	2 14 3

*Ex div.

well raise the chorus—"Happy men are we;" but they have not got quite that length yet, all that was done this week having been to send the draft to London for consideration by Messrs. Edmundson.

The Dumfries Town Council have done a very wise and a very generous action in connection with the water supply to a tannery in the neighbourhood of their works. The well at the tannery was found to be contaminated, and suspicion fell, as usual, upon the gas-works as the source of pollution. There was no certain proof that the belief was well founded; but the Gas Commission, rather than have any dispute over the matter, at their own expense sank an artesian well, from which they are now able to give a supply of water to the tannery, and they have sufficient left to meet their own wants. Both parties are to pump their own supplies—the Tanneries Company during the day, and the Gas Commissioners during the night. The spirit of compromise seems to have pervaded both parties, which is greatly to their credit, because the situation was one in which a great deal of money might easily have been wasted in endeavouring to discover the rights of parties. By the agreement which has been come to, both are accommodated, and no damaging admissions are made. The transaction is one which should be given every prominence to, with a view to encouraging its being imitiated by bodies similarly situated in other towns.

On Monday a new reservoir which has been constructed by the Perth Water Commission at Burghmuir, two miles from the city, was formally inaugurated by Lord Provost Dewar. The reservoir is erected at an elevation of 320 feet, which is an altitude sufficient to supply all the higher districts round the outskirts of the city for many years to come. The size of the reservoir is 121 feet square by 21·9 feet deep. When full, it holds 1,956,084 gallons, being 117,300 gallons more than the existing three reservoirs hold. The Lord Provost, in turning on the water, remarked that it was the intention of the Water Commissioners to extend and improve the other three reservoirs, so that in dry weather there would be no difficulty in getting a proper supply for the wants of the town. Bailie M'Leish presented his Lordship with a silver cup in commemoration of the event. On the invitation of the Lord Provost, cake and wine were served in a marquee erected on the ground—the Lord Provost presiding.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 14.

Sulphate of Ammonia.—The market has been quiet throughout the week, and without special feature; to-day's quotations being £7 8s. 9d. to £7 10s. per ton f.o.b. Leith and Hull, and £7 10s. to £7 11s. 3d. per ton f.o.b. Liverpool. Consumptive demand is still rather slow, although dealers appear to be offering abroad below prices current on this side; and the greater part of the purchasing has again been to fulfil previous speculative engagements. The quantities available are only limited; and prices are therefore maintained. For forward delivery, there is nothing fresh to report. There is fair inquiry for shipment over autumn months. But buyers' views are below the level of present prices; and consequently business drags. Makers are not keen about forward selling; and the premium asked by them practically precludes business.

Nitrate of Soda is very quiet at 7s. 4½d. per cwt. for ordinary, and 7s. 6d. per cwt. for fine quality.

LONDON, *Aug.* 14.

Tar Products.—Pitch buyers are at present hypercritical as to quality and their differentiating between the different makes is markedly shown in the great variation in the prices being paid and offered. Business has been done as low as 17s., and, almost concurrently, at as high a rate as 22s.—the latter, of course, being a very special product, free from impurities and containing very little free carbon. Oils are firm, with good inquiry; and benzols steady. Toluol is improving; and solvent naphtha is in good request. Anthracene is neglected; and the same may be said of naphthalene and salts. The following prices have been paid: Tar, 16s. to 20s. Pitch, 17s. to 22s. Benzols, 90's, 2s.; 50's, 2s. Toluol, 2s. 4d. Solvent naphtha, 1s. 7d. Crude, 30 per cent., naphtha, 11½d. Creosote, 2¼d.; liquid, 3d. Heavy oils, 42s. 6d. Carbolic acid, 60's, 2s. Naphthalene, 42s. 6d.; salts, 20s. Anthracene, nominal, "A" quality, 6d.; "B" quality, 5d.

Sulphate of Ammonia is being shipped freely. The market, however, does not respond to the improved inquiry as makers desire. There are no stocks of importance; while there is a fair inquiry all round, and it is expected the autumn will see an advance in price. To-day's value may be taken at £7 10s., less 3½ per cent. at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The business coming forward in most descriptions of fuel continues only limited in weight; and even with pits working short time, stocks are accumulating at most of the collieries. Common round coals are fairly maintaining their prices, notwithstanding plentiful supplies and some restriction of the demand as the result of the engineers' dispute. Taking the round coal trade all through, the remarkable feature is the steadiness with which prices have been kept up during the present summer; and at the pit mouth quotations remain at 9s. 6d. to 10s. per ton for best Wigan Arley; 8s. to 8s. 6d. for Pemberton four-feet and seconds Arley; 6s. 6d. to 7s. for common house coal; and 6s. to 6s. 3d. for steam and forge coal. The present limited output of engine fuel meets with a ready sale; and prices are very firm at 3s. 6d. per ton for common; 3s. 9d. to 4s. 3d. for medium; and 4s. 6d. to 4s. 9d. for best sorts at the pit mouth. The holiday stoppages in manufacturing districts, and the extension of the engineers' lock-out to the important centre of Oldham, will, however, have some effect in restricting requirements. Steam coal is in fairly good demand for shipment, and fetching from 7s. 6d. to 7s. 9d. per ton delivered at the Mersey ports.

Northern Coal Trade.—With an increasing demand for coal, prices

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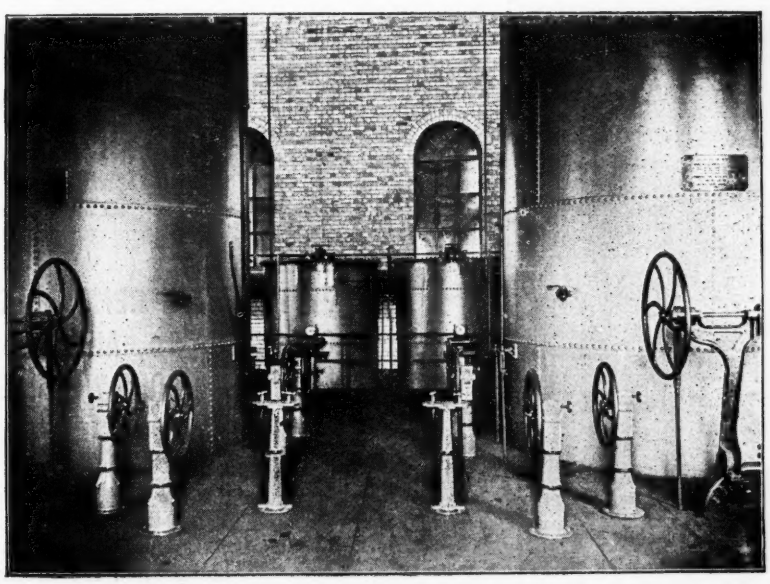

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.

seem improving, especially for Durham coals, as the season for enlarged consumption of the latter is approaching. Best Northumbrian steam coals are steady at 8s. 9d. per ton, free on board; second qualities, 8s. to 8s. 3d.; and steam smalls, 3s. 6d. to 3s. 9d. In the gas-coal trade there is an increase in the demand; and where higher prices are asked, it is understood that they have been paid when the terms of delivery can be arranged. Some of the large producers have sold most of the output of their collieries for some time ahead. The price generally quoted is about 7s. 6d. to 7s. 9d. per ton, free on board. But one firm asks 8s. for best Durham gas coal, and is believed to have obtained that price this week. The coke trade is decidedly firmer, though unequally so; and the advances in price are mainly for lots for export that are needed for rapid delivery. Generally about 16s. 6d. to 17s. per ton, free on board, is the quotation for export qualities. For blast furnace coke, the price is now about 13s. 6d. to 13s. 9d. per ton at the local furnaces, and the full production seems well taken up. Gas coke shows no alteration in price this week; but the production increases though it is well taken up.

Scotch Coal Trade.—Activity continues; and during the past week prices showed a disposition to improve. Steam and ell of the best qualities are in good request. There are large outputs of splint; but most of it is contracted for, and on account of the storage going on in gas-works, it is finding a ready outlet. Main is unchanged. Rumours prevailed at the beginning of the week, of an application by the miners for an increase of wages, by 1s. per day; but the general opinion is that, until the engineering trouble is over, an advance is impossible. The engineers have not, as yet, affected the coal industry to any extent; but on Friday a meeting of the federated and non-federated employers was held in Edinburgh, at which the resolution was unanimously come to to "fight the forty-eight hours question to the death." There is some ambiguity about the expression; but whatever it means, it points to a prolonged struggle, and the effect may be felt in the coal trade. The prices quoted are: Main, 6s. 6d. per ton, f.o.b., Glasgow; ell, 7s. to 7s. 6d.; splint, 6s. 9d. to 7s. The shipments for the week amounted to 197,604 tons—an increase upon the previous week of 11,960 tons, and upon the corresponding week of last year of 28,553 tons. For the year to date the total shipments have been 4,644,022 tons—an increase upon the corresponding period of last year of 182,915 tons.

The New Water-Works for Bilston.—Last Thursday the new water-works established by the Bilston Urban District Council at the Bratch, Wombourn, were formally opened in the presence of the members of the Council, and many of the principal residents of Bilston and district. The works have been supplying water to the township for more than twelve months; the area supplied also including Coseley, Trysall, and Leisdon. The quantity consumed is about 600,000 gallons per day, and the pumping machinery is equal to double this amount. The total cost of the works was £45,000. The inaugural ceremony was performed by Mr. R. A. Harper, the Chairman of the District Council, who was presented by the Engineer (Mr. Baldwin Latham) with a silver gilt key, by which the door of the main entrance to the building was opened.

New Reservoir for Margate.—The Margate Town Council have decided to construct at Cliftonville a high-service reservoir capable of holding 500,000 gallons of water, for the better supply of that part of the town.

The Management of the Briton Ferry Gas-Works.—At the last meeting of the Briton Ferry District Council, a letter was read from Mr. Lea, who had been selected to succeed Mr. W. Cheyne as Manager of the gas-works, stating that he could not accept the position, as he was bound to give two months' notice to his present employers. It was recommended that the Council should select from the last applicants three candidates to appear before the Council.

Torrington Water Supply.—The question of improving the water supply of Torrington is becoming a pressing one. At a recent meeting of the Town Council, it was reported that the depth of water in the reservoir was 11 ft. 6 in., and that it was decreasing at the rate of 4 inches per day. Negotiations have been proceeding with the Water Company for the transfer of the works to the Corporation, in conformity with the agreement already arrived at; but a difficulty has arisen respecting the title to the collecting area. The Water Committee recommended that steps be taken at once to formulate a scheme for securing an adequate supply of water, and that the question of title should be cleared up. It was decided to ask the Company to furnish a proper title, and to request Mr. Baldwin Latham to submit an estimate of the cost of an additional supply.

The Quality of the Belfast Water Supply.—There having been a little doubt expressed as to the quality of the water supplied by them, the Belfast City and District Water Commissioners took the sensible course of early repressing any fear in that direction by asking Dr. Percy Frankland to personally inspect the watersheds, reservoirs, and filters, and take samples of water for examination. This he has done, with the result that he is able to present to the citizens an exhaustive report showing that the supply is most satisfactory. It appears that from the nature of the gathering-grounds, the water collected is liable to contain a large proportion of organic matter, which is almost conclusively of vegetable character; and it is imperative that water of this kind should be submitted to prolonged storage and careful filtration. With storage capacity, the Commissioners are well provided; and they have also an admirable series of filter-beds, constructed on the most approved principles, and worked with great care and attention. The analyses which Dr. Frankland has made of the water before and after passing through the filters, show that the filtration is highly efficient in the removal of organic matter, while the bacteriological examinations unmistakably indicate its efficiency in the removal of micro-organisms. In order to secure the best possible results in filtration, Dr. Frankland recommends that great attention should be paid to the following points: (1) Running to waste as much of the filtrate as can be spared after each cleaning. (2) Uniformity in rate of filtration employed; sudden changes to be carefully avoided. (3) The employment of the lowest practicable rate of filtration throughout. (4) The use of the finest sand procurable.

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Proposed New Storage Reservoir at Taunton.—At a meeting of the Taunton Town Council last Tuesday, the Water Committee submitted plans and specifications for a new storage reservoir with a capacity of 119 million gallons. The cost, including the land and water rights, is estimated at £31,500. It was decided to apply to the Local Government Board for sanction to a loan of this amount, repayable in fifty years.

Barnet District Gas and Water Company.—At the half-yearly meeting of this Company on the 27th inst., the Directors will report that the balance of the profit and loss account is £16,521, out of which they will recommend the declaration of dividends (less income-tax) at the rates of 9, 8, and £6 6s. per cent. per annum on the various stocks of the Company for the six months ending June 30. The Directors state that the business is progressing.

The Public Lighting of Aldeburgh-on-Sea.—As the result of an advertisement for tenders for lighting the town, the Aldeburgh Town Council have only received one, and it was from the Aldeburgh Gas Company. As the Company refused to be tied to any penalties, or to fit the lamps with incandescent burners, the Council have declined their offer; the consequence being that, now the season has commenced, there are no arrangements made for lighting the public streets.

The Proposed Purchase of the Leamington Gas-Works by the Corporation.—Mr. Thomas Newbigging has been consulted by the Leamington Town Council on the question of the purchase of the gas-works; and a small Committee who have had the matter in hand has recommended to the General Purposes Committee that the works should be purchased on terms named by Mr. Newbigging in his report. It has been arranged that Mr. Newbigging shall have an interview with the latter Committee at their next meeting; and thereafter the subject will be discussed by the Council.

The Growth of the Auckland (N.Z.) Gas Company.—An interesting gathering of the Directors and employees of the Auckland (N.Z.) Gas Company took place on the evening of the 1st ult., when the latter were entertained at dinner by the former in honour of Her Majesty's Diamond Jubilee. The occasion was also chosen to give a welcome to the new Engineer and Manager (Mr. Chenery Suggate), who arrived in Auckland about the middle of April. Mr. J. H. Upton, the Chairman of the Board, presided; and in the course of his after-dinner speech remarked that this was the first occasion in Auckland, if he remembered rightly, when men engaged in one common enterprise had met together at a gathering of this kind; at all events, it was the first time in the history of the Company. It showed that there was a good feeling existing between them; and it was setting a good example to others. He expressed the hope that it would not be the last occasion for the Directors and the men to so meet. With regard to their new Manager, he said he was sure he would receive the support of both the Board and the workmen. Subsequently, the Secretary (Mr. E. B. Parsons) gave a few particulars as to the origin and growth of the Company. He said that if the gathering had been held a week later—on the 8th instead of the 1st of July—it would have been the 35th anniversary of the date on which a public meeting was called to take into consideration the question of promoting a Company for the manufacture of gas for the supply of the town—it was not a city then—of Auckland. The Auckland Gas Company was duly formed, and was the fourth undertaking registered under the newly-passed Joint-Stock Companies' Act. A good deal of time was occupied in completing the works; and it was not till April 15, 1865, that gas was supplied to the town for the first time. On June 7, 1866, the Company had 325 consumers—just the number they had put on their list during the past ten months. Eighteen months later, he joined the Company. The wages then amounted to £8 15s. per week—a sum which would not go very far at the present date. Mr. Suggate also addressed the meeting, at the invitation of the Chairman, and spoke hopefully of the future of Auckland and its gas supply.

The Liskeard Corporation and the Water-Works.—Though the feeling in Liskeard appears to be almost wholly in favour of the Corporation purchasing the water-works, there are certain financial considerations which trouble even ardent advocates of the scheme. It is generally agreed that the price at which the Company are willing to sell their works is fair and reasonable; but it is doubted whether the Corporation can pay it and carry on the works without making an annual call upon the ratepayers. A great deal will depend upon the period which is allowed for the repayment of the purchase-money. At a meeting of the Town Council last Tuesday, the Town Clerk read some correspondence he had had with the Local Government Board on this subject. The Board stated that thirty years was the longest term for which they would be willing to sanction a loan for the purpose; but if an Act of Parliament was obtained, the period might be longer. They could not now say what course they might pursue in the event of the Corporation promoting a Bill for the purpose of extending the period for the repayment of the loan. Another question on which the advice of the Local Government Board was asked was whether the Corporation would be able to charge, like the present Company, water-rent upon the gross rental. It has been pointed out that if the water-rent is assessed upon the net rateable value, the income will be reduced below the present amount of £875 per annum; while if only thirty years is allowed for the repayment of the loan, the Corporation will need an income of £1000 per annum. The Local Government Board wrote that the Council would be empowered to make precisely the same charges in respect of the supply of water to premises as the present Company levy under their Act. Mr. R. H. Lee thought this was incorrect; and he suggested that an expert should be called in. The Mayor (Mr. A. W. Venning) said the Town Clerk had appealed to the "Justice of the Peace," whose reply was that the word "value" must be taken as equivalent to rack-rent, and therefore meant the gross estimated, as distinguished from the rateable, value. Mr. Lee said he did not care for that or any other authority; and he was prepared to prove his contention that the Corporation could only charge on the rateable value. It was decided to communicate further with the Local Government Board on the matter.

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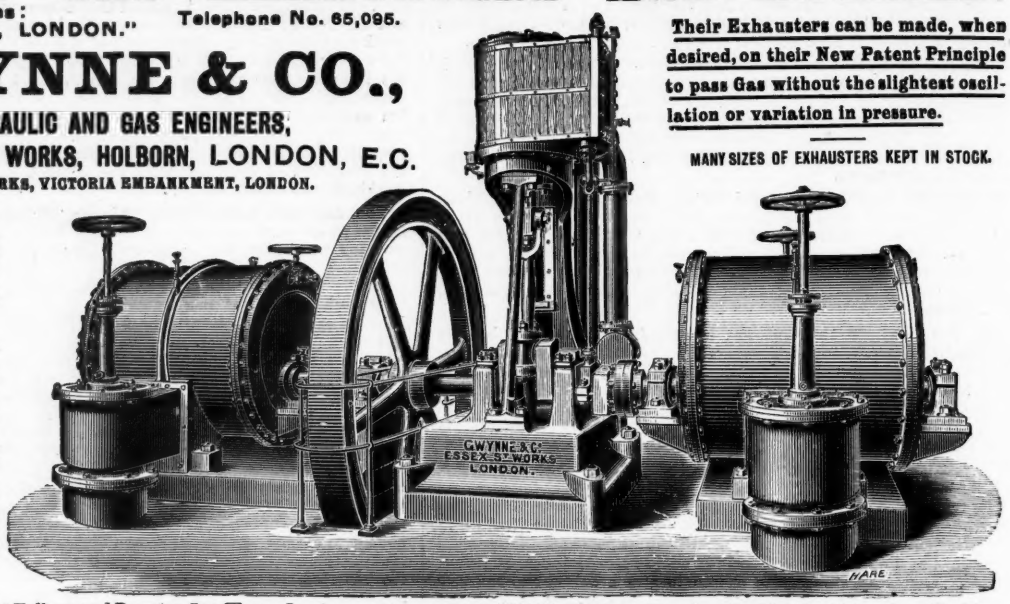

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.
Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 800 British Gas-Works.
ANDREW STEPHENSON, 182, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.
Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR wanted.
BROTHERTON AND Co., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

TO GAS AND WATER OFFICIALS.
SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.
JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see Aug. 3, p. 250.]

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravelly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

ECONOMY IN PURIFICATION.
INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.
BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.
JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

BLUE PRINTS of all kinds in any weather. Drawings and Tracings promptly executed.
J. L. FEATHERSTONE, 21, Old Queen Street, WESTMINSTER, S.W.

PATENTS FOR INVENTIONS.
J. C. CHAPMAN, M.I.M.E. and Fe'. Chartered Inst. Patent Agents. ADVICE OF ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SULPHATE OF AMMONIA SATURATORS.
WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

HYDRATED OXIDE OF IRON.
PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

IMPORTANT TO GAS ENGINEERS AND MANAGERS.

YOUR old Retorts made as good as new by Repairing them with CROWTHER'S STICK-FAST FIRE CEMENT. Can be used in Hot or Cold Retorts. Unequalled for the Repair of Inclined Retorts. Satisfaction Guaranteed.
Write CROWTHER, Practical Retort Setter, Manor Street, HUDDERSFIELD.

TRAVELLER, with good Connection among Gas Companies, is open to ENGAGEMENT, or would take MANAGEMENT and TRAVEL when required. Undeniable References.
Address No. 2886, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION Wanted as Main and SERVICE LAYER and GENERAL FITTER, or as WORKING FOREMAN of small Works. Can read Meters, &c. First-class References.
Address No. 2896, care of Mr. King, 11, Bolt Court, FLEET STREET E.C.

STOKER (married and middle aged) seeks a Situation. Used to Engine and Exhauster and Shovel Charging. Could take charge of Small Works, without Fitting. Four Years' Character.
Address HENRY WILSON, Gas House Cottages, Felixstowe, SUFFOLK.

STOKER Wanted. Must be a good Shovel Charger, and used to Engine and Exhauster. Wages 24s. per week. Constant job to a steady Man.
Apply for further Particulars, to C. JEFFERY, Manager, &c., Gas-Works, Portland, DORSET.

ENGINE Fitter. Wanted, a leading hand at large Gas-Works. One accustomed to Gas Plant and Machinery preferred. Age, under 40.
References, Wages required, &c, by letter, to No. 2900, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two Stokers, in small Works for Day and Night Shifts (Shovel Charging). Wages 18s. per week, with House, Garden, Coal, and Gas.
Apply, by letter, to No. 2897, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Stokers (Two) wanted, used to Shovel Charging, and Engine and Boiler. Permanent job to steady Men. Wages 4s. 6d. per twelve-hour Shift.
Apply, by letter only, to T. LAYTON, Manager and Secretary, Gas-Works, REDDITCH.

WANTED, a Foreman of Water-Works Pumping-Station in Staffordshire. Wages 32s. per week, with House and Coal.
Apply, in own handwriting, stating Age, Married or Single, and giving full Information as to previous Experience, with References or Testimonials, to No. 2888, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PUPIL WANTED.

A VACANCY will occur next Month for a PUPIL in the Office of a Gas Engineer in the Midland Counties. A large portion of the Premium will be returnable as Salary during the Three Years' Apprenticeship.
For full Particulars, apply, by letter, to No. 2901, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Junior Clerk accus- tomed to the routine of a Gas Office.
Applications, stating Age, Salary required, and References or Testimonials to be sent to the undersigned not later than Tuesday, the 24th of August.
W. S. M'GREGOR,
Engineer and Secretary.
Gas Offices, Heathcote Road, Longton.

WANTED, an experienced Clerk and ACCOUNTANT (Age not under thirty), to take charge of the Books and Office Work of a Gas Company in a rapidly growing district on the East Coast.
Salary, £120 per annum.
Only those experienced in the keeping of Gas Company's Accounts, and whose Character will bear the strictest investigation, need apply.
Address No. 2899, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE London County Council are pre- pared to receive APPLICATIONS for the position of CHEMIST of the Council. Candidates must have had a thorough experience in Analytical Work, especially in connection with Water, Sewage, Foods, Drugs, and General Stores, and in Gas Testing.
The Salary will be £700 a year.
The Person appointed will be required to give his whole time to the duties of his office.
Forms on which application is to be made and further Particulars can be obtained from the Clerk, London County Council, Spring Gardens, S.W.
The latest time for receiving applications is Ten o'clock a.m., on Saturday, the 11th of September.
Any form of application which is not filled up, or which in any respect fails to comply with the terms of the advertisement, will not be laid before the Council.
Personal canvassing is strictly prohibited.
C. J. STEWART,
Clerk of the Council.
County Hall, Spring Gardens,
July 23, 1897.

WANTED, a thoroughly efficient and experienced FOREMAN MAINLAYER.
Apply, stating Wages required, Age, and Experience, to W. A. PADFIELD, Gas Offices, EXETER.

ROTHERHAM CORPORATION GAS-WORKS.

FOREMAN WANTED.

WANTED, a Carbonizing and General FOREMAN at the above Gas-Works. The duties include the working of all Machinery and Boiler Firing. Must be accustomed to Exhausters. Wages £2 per week. Eight-hour Shifts.
Inquiries for further Information and Applications, with References, to be addressed to Mr. MATTHEW MURDOCH, Manager, Gas-Works, ROTHERHAM.

WANTED, a second-hand Washer- SCRUBBER, with 6-inch or 8-inch Connections. Give full Particulars and Price on Rail to No. 2898, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

WANTED, Second-hand Mouthpieces, BRIDGE and DIP PIPES, and HYDRAULIC MAIN, for Two Benches of Fives (15-inch Round Retorts). Also an EXHAUSTER and GAS-ENGINE, to pass 25,000 Cubic Feet per diem; and a VERTICAL CONDENSER, with 6-inch Connections.
Apply, by letter, to No. 2892, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.
Apply to JOHN H. DARBY, Brymbo, near WREXHAM.

PURIFIERS, second-hand, in excellent condition. Set of Four, 16 feet square, 15-inch Centre-Valve, and Connections, complete with Lifting Apparatus. Price moderate.
Address D. M. NELSON AND CO., 53, Waterloo Street, GLASGOW.

GAS-PUMP for Sale, horizontal, one Steam Cylinder, 18-inch bore, and two Gas Cylinders, 17½-inch bore, all 24-inch Stroke, on massive Bed-Plate, with heavy Fly-Wheels. Very strong. First-Class Make. Not much used.
Apply, by letter, to No. 2878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Two Gasholders: One 18 ft. diameter by 14 ft. deep; and the other 20 ft. by 14 ft. In good condition, with Columns, Girders, Counterbalance Valves, and Connections complete. Also an EXHAUSTER, by Gwynne and Beale (capacity 2000 feet per hour). Has only been used Six Months.
Apply to the DRAYCOTT GAS COMPANY, Draycott, DERBY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

OXIDE OF IRON.

THE Gas Committee are prepared to receive TENDERS for the supply of 600 Tons of OXIDE OF IRON PURIFYING MATERIAL.
Full Particulars may be obtained of the Gas Engineer, Gas Offices, Bloom Street, Salford.
Sealed tenders, endorsed "Oxide of Iron," to be sent to me not later than Five p.m., on Thursday, Aug. 26, 1897, addressed to the Chairman of the Gas Committee, Town Hall, Salford.
By order,
SAML. BROWN,
Town Clerk.
Town Hall, Salford,
Aug. 14, 1897.

BOROUGH OF BEVERLEY.

TENDERS FOR COAL.

THE Gas Committee are desirous to receive TENDERS for the supply of COAL for a period of Twelve Months from the 1st of October next, to be delivered, as from time to time directed, by, and at the expense of, the Contractors f.o.b. at Keadby, or at the Pits, or at the Railway Station, Beverley, according to the terms of Contract.
The Coal to be of the best kind, well screened, free from Sulphur, Bats, Bind, Refuse and Dirt, and to be weighed (21 cwt. to the ton) upon the Corporation Machine.
Payments will be made monthly so long as the contract shall be duly fulfilled.
The Corporation do not bind themselves to accept the lowest or any tender.
Further Information may be obtained of the Gas Manager, Mr. James Gibson, at the Gas-Works, Beverley; and tenders, endorsed "Tender for Coal," must be delivered at my Office not later than Tuesday, the 31st of August, 1897.
By order,
J. WILLIS MILLS,
Town Clerk.
Guildhall, Beverley,
Aug. 14, 1897.

STOCKTON-ON-TEES CORPORATION.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply in whole or in part of 35,000 Tons of GAS COAL for the Year ending Sept. 30, 1898.
Particulars and Form of Tender can be obtained on application to the undersigned at the Gas-Works.
Tenders, sealed and endorsed "Tender for Gas Coal," to be sent in not later than noon of the 26th day of August, 1897, addressed to M. B. Dodds, Esq., Town Clerk, Stockton-on-Tees.
The Gas Committee do not bind themselves to accept the lowest or any tender.
WILLIAM FORD,
Engineer and Manager.
Gas-Works, Stockton-on-Tees,
Aug. 3, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO BOILER MAKERS.

THE Directors of this Company invite TENDERS for the construction and delivery to their Grimesthorpe Station of one LANCASHIRE STEAM-BOILER, 30 ft. long, by 7 ft. 6 in. diameter.
Copy of the Drawing and Specification, with Form of Tender, may be obtained upon application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d. (not returnable).
Sealed tenders, endorsed "Tender for Boiler," must be delivered to the undersigned by post at the Company's Offices not later than the first post on Saturday, the 4th day of September next.
The Directors do not bind themselves to accept the lowest or any tender.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Aug. 14, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

FIRE-CLAY GOODS.

THE Directors of this Company invite TENDERS for the supply of FIRE-CLAY GOODS required for the construction of Fifteen REGENERATIVE RETORT-SETTINGS at their Grimesthorpe Station.
Specification and Form of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.
Sealed tenders, endorsed "Fire-Clay Goods," must be delivered by post to the undersigned at the Company's Offices not later than the first post on Saturday, the 4th day of September next.
The Directors do not bind themselves to accept the lowest or any tender.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Aug. 14, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO IRONFOUNDERS, &c.

THE Directors of this Company invite TENDERS for the following for their Grimesthorpe Station:—
CONTRACT No. 46—The supply and erection of a CAST-IRON VERTICAL PIPE CONDENSER. The Condenser to consist of 250 Pipes, 18 inches diameter, with Arch Pipes, Bottom Boxes, Girders, and Connections complete.
CONTRACT No. 47—The supply and erection of CAST-IRON STANDARDS, GIRDERS, and PLATES to form a Stage-Floor, for the Retort-House. The House is 360 feet long, by 70 feet wide.
Drawings may be seen, and Specifications, with Bills of Quantities and Forms of Tender, obtained, on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d. each contract, which will be returned on receipt of a *bonâ-fide* tender.
Sealed tenders, endorsed as above, must be delivered not later than the first post on Saturday, the 4th day of September next, to the undersigned at the Company's Offices.
The Directors do not bind themselves to accept the lowest or any tender.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Aug. 14, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO ENGINEERS, IRONFOUNDERS, AND STEEL PIPE MAKERS.

THE Directors of this Company invite TENDERS for the following for their Grimesthorpe Station:—
CONTRACT No. 48—The supply and erection of STEEL PIPES to form Foul-Gas Mains. The Contract includes about 820 feet of 36-inch diameter Pipes and 860 feet of 30-inch diamster Pipes.
CONTRACT No. 49—The supply and delivery of 30 FURNACE DOOR ASH-PANS and SUNDRY CASTINGS.
Copies of Drawings and Specifications, with Forms of Tender, may be obtained on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d. each contract (not returnable).
Sealed tenders, endorsed as above, must be delivered not later than the first post on Saturday, the 4th day of September next, to the undersigned at the Company's Offices.
The Directors do not bind themselves to accept the lowest or any tender.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street, Sheffield,
Aug. 14, 1897.

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIA WATER made at their Works for the Year ending Sept. 1, 1898.

Tenders to state Price per Ton for Tar and for Ammonia Water of from 4° to 8° Fahr. at Barnoldswick Station (Midland Railway).

The annual quantity produced is about 100 Tons of Tar, and 230 Tons of Ammonia Water.

Tenders to be sent in to the undersigned not later than Sept. 1 next, endorsed "Tender for Tar."

The highest or any tender not necessarily accepted.

D. E. GARLICK,
Manager.

Gas Offices, Barnoldswick,
vid Colne.

MITCHAM AND WIMBLEDON DISTRICT GASLIGHT COMPANY.
(INCORPORATED BY ACT OF PARLIAMENT, 1867.)

NOTICE is Hereby Given, that the SIXTY-FIRST ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of this Company will be held in the Board-Room, at the Works, Mitcham, in the County of Surrey, on Tuesday, the 31st day of August, 1897, at Three o'clock in the Afternoon precisely, to receive the Report of the Directors and a Statement of the Accounts for the Half Year ended the 30th day of June last, to declare a Dividend, and for General Business.

The TRANSFER BOOKS WILL BE CLOSED from the 16th inst. until after the Meeting.

By order,
BENJAMIN GREEN,
Secretary and Manager.

Offices and Works: Western Road,
Mitcham, Aug. 3, 1897.

ROBERT MARSHALL,
CANNEL COAL MERCHANT
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

BRISTOL WATER-WORKS COMPANY.

CONTRACT No. 11.
TO CONTRACTORS FOR PIPE LAYING.

THE Directors of the Bristol Water- Works Company are desirous to receive TENDERS for the LEADING and LAYING (except the Jointing) of about 5 miles of CAST-IRON SOCKET PIPES of 30 inches diameter.

Drawings may be inspected, and Specifications and Forms of Tender may be obtained, at the Office of the Company in Small Street, Bristol, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Friday, the 20th day of August inst.; and Tenders, endorsed "Tender for Trench Work, &c.," must be delivered at the Office of the Company in Bristol, at or before Ten o'clock in the Forenoon of Saturday, the 4th day of September next.

The Company do not bind themselves to accept the lowest or any tender.

By order,
ALFRED J. ALEXANDER,
Secretary and General Manager.

Bristol, Aug. 13, 1897.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Offices, Willoughby Lane, Tottenham, on Saturday, the 28th day of August inst., at half-past Three o'clock in the Afternoon precisely, to receive the Report of the Directors and the Statement of Accounts for the Half Year ended the 30th day of June, 1897, to declare a Dividend for the same period, and for the Election of two Directors and an Auditor for the ensuing Year, and for transacting the General Business.

The TRANSFER BOOKS WILL BE CLOSED for CONSOLIDATED STOCKS from the 13th to the 30th of August inst., both days inclusive.

By order,
JAMES RANDALL, Secretary.

Offices of the Company:
Willoughby Lane, Tottenham,
Aug. 6, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 $\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13$\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13$\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94$\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

SAWER & PURVES,
MANCHESTER.

SOLE MAKERS OF THE

"POSITIVE"
PREPAYMENT GAS-METERS
WET and DRY.

DRY PREPAYMENT METER,
TIN-PLATE CASE.

SIMPLICITY IN MECHANISM
Combined with
STRENGTH AND COMPACTNESS.

PRICE OF GAS EASILY CHANGED.

MADE TO TAKE ANY COIN.

PRICES AND ALL PARTICULARS CAN BE HAD ON APPLICATION.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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LONDONDERRY GAS COALS

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MARQUIS OF LONDONDERRY'S COLLIERIES,

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Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

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SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

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HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

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THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 „
Ash	2·73 „

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E. ASQUITH & CO.,

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Fit up Plants for

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Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
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Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

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Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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THE IDEAL LIGHT FOR DOMESTIC USE.

Price from **5/3** Complete.

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THE MANTLES ARE THE STRONGEST IN THE TRADE.

"COSMO" BURNERS Complete, as shown, 12-inch Shade, 7/9 each. Price List and Terms on Application.

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PREPAYMENT GAS-METER

FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
3. Impossibility of being tampered with.
4. Unaffected by irregularities in shape or thickness of the penny.
5. Can be fixed to any ordinary Wet or Dry Meter.
6. Extra large Money-Box.
7. Price Changer can be altered without otherwise disturbing the Meter.
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ADOPTED AT HORNSEY, HASTINGS, SOUTHEND,

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OF EVERY SIZE AND DESCRIPTION.

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IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

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Nitrate of Thorium, Chemically Pure, at lowest Prices.
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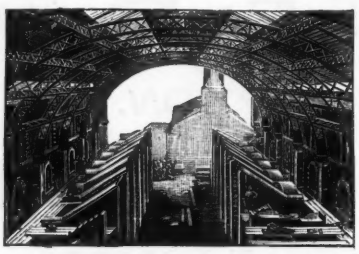

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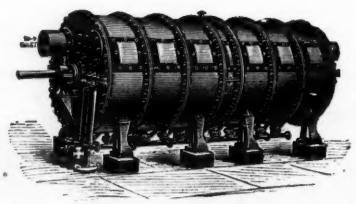

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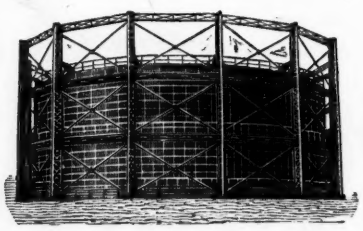

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.
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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

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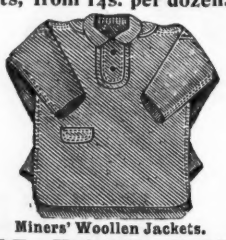

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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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Patent Automatic Machinery

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Full Particulars may be obtained from the Sole Makers,

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[See Illustrated Advertisement, Aug. 3, p. 295.]

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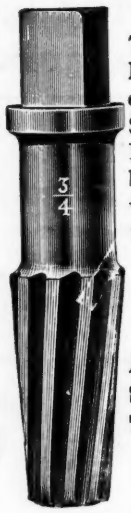
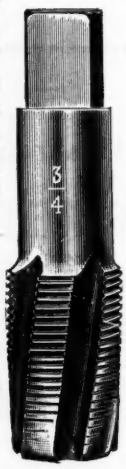


These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much longer than straight grooved Taps and Rymers.

THOUSANDS ARE IN DAILY USE.



Also SCREWING-MACHINES, STOCKS and DIES (with Patent Twisted Dies), PIPE-TONGS, and other TOOLS.

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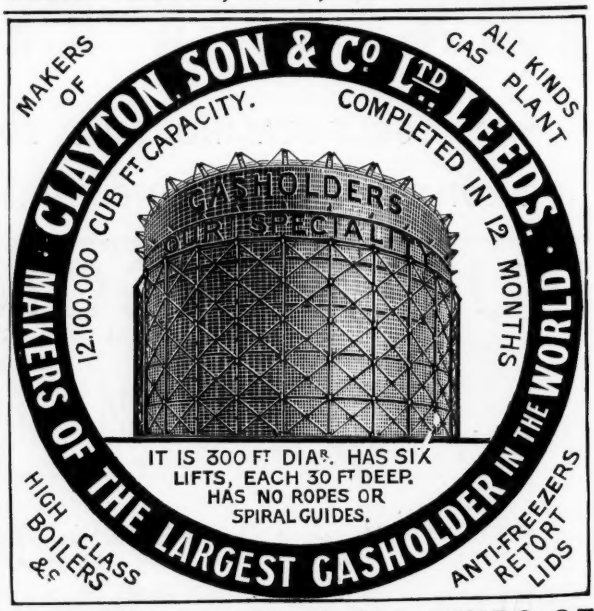
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ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GAS HOLDERS
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IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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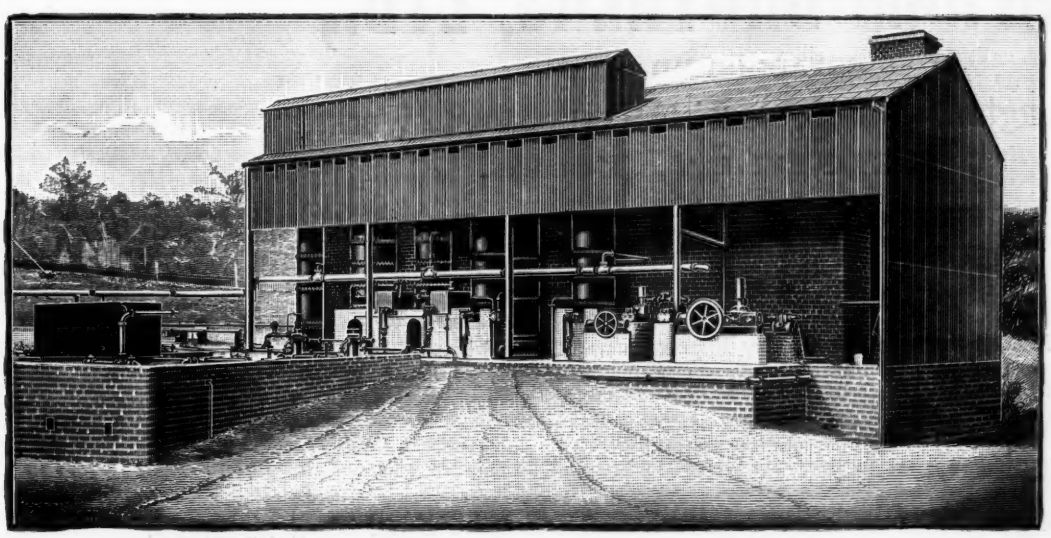

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Analysis: 12,600 Feet of 19-Candle Gas per Ton.

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RETORT BENCHES ERECTED COMPLETE
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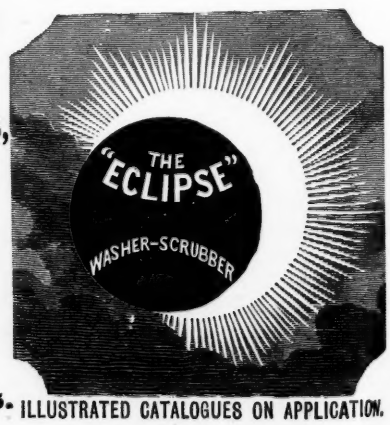

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GAS and WATER VALVES and MAINS. ILLUSTRATED CATALOGUES ON APPLICATION.

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LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Aug. 17, 1897.